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REVIEW OF APPLIED ENTOMOLOGY.

SERIES B: MEDICAL AND VETERINARY.

VOL. I.

Insects

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ERRATA.

Page	7	line 12	for " *ngamiensis* "	read *nagamiensis.*
,,	36	,, 37	,, " Vandenbraden (J.) "	,, Vandenbranden (F.)
,,	46	,, 10	,, " Mbornu "	,, Mbomu.
,,	54	,, 38	,, " *scabei* "	,, *scabiei.*
,,	64	,, 34	,, " *Culex* "	,, *Culicoides.*
,,	65	,, 11	,, " midge larvae "	,, midge (*Culicoides*) larvae.
,,	65	,, 15	,, " Other larvae "	,, Other *Culicoides* larvae.
,,	80	,, 11	,, " Cragg (E. W.)"	,, Cragg (F. W.)
,,	85	,, 28	,, " Enslin (B. S. L.) "	,, Enslin (B. G. L.)
,,	87	,, 31	,, " *X. cheopis* "	,, *Xenopsylla cheopis.*
,,	134	,, 3	,, " *rhodiense* "	,, *rhodesiense.*
,,	,,	,, 34	,, " Энтомоуогій "	,, Энтомологіи.
,,	143	,, 17	,, " *Taeniorhynchus obturbans* "	,, *Taeniorhynchus perturbans.**
,,	176	,, 9	,, " *Tersethes* "	,, *Tersesthes.*
,,	185	lines 13, 19 and 25	for " *rotundatus* "	,, *boueti.*
,,	193	line 34	,, " Vassiliev (J. B.)"	,, Vassiliev (I. V.)
,,	204	lines 12, 15, 32 and 35	for " Sick paralysis "	,, Tick paralysis.
,,	209	line 47	,, " *sanguinolentis* "	,, *sanguinolentus.*
,,	215	,, 15	,, " on "	,, an.
,,	,,	,, 28	,, " Spirochetes "	,, Spirochètes.
,,	225	,, 10	,, " *ocenia* "	,, *oceaniae.*

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*[*T. perturbans* is a purely New World species, and the insect referred to is probably *Mansonioides uniformis.*—Ed.]

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Wenyon (C. M.). **Experiments on the Behaviour of *Leishmania* and allied Flagellates in Bugs and Fleas, with some Remarks on Previous Work.**—*Jl. Lond. Sch. Trop. Med.* II. Pt. 1. Dec., 1912. pp. 13-26.

It was first shown by Patton that the parasite of Indian kala azar would develop into flagellates in the gut of *Cimex rotundatus*. More recently Patton has repeated these experiments not only with *Cimex rotundatus* but also with *C. lectularius*. In the latter series of experiments he found that the flagellate forms first produced give rise ultimately to small post-flagellate forms which have no flagellum. It is these post-flagellate forms which Patton thinks enter the body when the infected bug bites (probably by a regurgitation from the stomach of the bug) and give rise to kala azar. The direct transmission of kala azar to animals by the bug has not been effected.

In 1910 the author discovered that the bed-bug of Bagdad (*Cimex rotundatus?*) would take up *Leishmania* from Oriental sore and that in it the parasites developed into flagellate forms. This observation was later confirmed by Patton, who was working with Oriental sore in Cambay in India. Patton came to the conclusion that the bug was also the transmitter of Oriental sore. In the author's report on Oriental sore he contested the view that the bed-bug was the transmitter of Oriental sore and kala azar, and explained the development which took place in the bug as comparable with that which *Leishmania* would undergo when introduced into blood-agar media in a test-tube.

Patton rejects the author's view as to development in the bug on the ground that the following Arthropoda—*Culex fatigans*, *Anopheles (Neocellia) stephensi*, *Stegomyia sugens*, *Ornithodorus savignyi*, *Pediculus capitis*, and *Pediculus humanus (vestimenti)*—do not permit of these parasites developing to the flagellate stage, and that Cambay boil will not develop in *Stegomyia*. The author experimented with *Stegomyia* in Bagdad and found flagellate forms in a large percentage which had been fed on diseased persons and none in those fed on healthy persons. Patton thinks there is some error of observation and that these flagellate forms seen were not really those of *Leishmania*. The author holds his observations to be correct and that Patton's negative results are inconclusive.

The question as to whether the gut of the bed-bug affords a suitable culture-tube for flagellates the author regards as settled in the affirmative, and thinks it probable that the gut of the arthropods above-named contain some substance injurious to *Leishmania*. In proof of the innocuous nature of the contents of the gut of the bed-bug, he cites (1) his own observation that the spirochaetes of relapsing fever will remain active therein for seven days, and appear normal in stained films after three weeks in the bug's gut; (2) Brumpt's observation that *Schizotrypanum*

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cruzi will undergo development in the bed-bug and is infective for ten days when injected into animals. *S. cruzi* will develop not only in *Cimex lectularius*, but also in *C. boueti* and in *Ornithodorus moubata*, which are all unable to transmit the infection as does the true host of *S. cruzi*, a species of *Conorrhinus;* (3) Swellingrebel and Strickland's proof that *Trypanosoma lewisi* will develop in the gut of *C. lectularius;* the author has himself confirmed these observations; (4) the author's own experiments with bugs fed on rats infected with *T. rhodesiense;* the gut yielded trypanosome and crithidial forms and rounded parasites seven days after feeding.

Patton thinks that the parasite of Mediterranean infantile kala azar will be found to flagellate in *Cimex lectularius*. The author is of opinion that the same is true of the *Leishmania* of canine kala azar and of the dermal leishmaniasis of South America.

The final stage of development of Leishmania.

Patton, in his last report on kala azar, lays great emphasis on the appearance in the bugs of what he calls the post-flagellate forms, which are rounded forms developed from the flagellate forms. In the life-history of a typical *Herpetomonas* of any insect such rounded forms are developed from the flagellates in the hind gut, and it is these which, protected by some kind of covering, pass out in the faeces, and are responsible for the transmission of the infection to a new host. The round forms of *Leishmania* found in bugs after the eighth day are compared by Patton with the post-flagellate forms of a *Herpetomonas*, and he is convinced that he has traced the whole development of the *Leishmania* from the forms ingested through the flagellate stage to the post-flagellate. In the bug, however, the post-flagellate forms are not found in the hind gut but in the mid gut, and it is supposed that they gain entrance to a new human host by regurgitation when the bug bites.

It is very difficult to decide whether the forms seen in the bug are true post-flagellates in the same sense as those which occur in insects. The author considers Patton's reliance on a staining reaction as misplaced, but the ultimate production of round forms in the mid gut of the bug is evidence of the similarity of behaviour of the *Leishmania* in the culture tube and in the intestine.

Patton has shown that the flagellate forms in the bug are destroyed by a second feed of blood and attributes their absence in man to the effect of the blood and argues that the round post-flagellate forms must be produced before infection can take place. Artificial cultures of *Leishmania* may produce both Oriental sore and kala azar when injected into animals. It must therefore be some more resistant form in these cultures—a post-flagellate—which causes the infection.

The Development of Leishmania *in the Bug is a very restricted one.*

Experiments with Oriental sore are much more difficult to conduct than with kala azar. The author emphasises the fact that the number of flagellates found in the gut of a bug after a few days, varies directly with the number of parasites ingested. In Oriental sore the number of *Leishmania* taken up must be very small and there is never a large infection with flagellates; while in Patton's last experiments, in which the bugs were fed on a heavily infected case of Kala Azar with numerous parasites in the peripheral blood, he obtained large numbers of flagellates.

If the bug were the true host of the *Leishmania*, complete infection of the gut would take place whether many or few parasites had been ingested, a longer time only being required to show a large infection when the parasites were few. In insects infecting themselves with *Herpetomonas* the author thinks it is not necessary that large numbers should be ingested to secure heavy infection.

Effect of a second feed of blood on the flagellates in Insects.

Patton has shown that a second feed of blood is fatal to the flagellate forms of *Leishmania* in the bug. This the author regards as fatal to the bug hypothesis. He kept fleas under observation, some infected with *Herpetomonas* and others with *Trypanosoma lewisi*. One flea had 16 feeds of human blood in two months. The faeces voided during feeding were constantly infected with *Herpetomonas* in large numbers, so that active multiplication must have gone on. Two other fleas in the same way showed the small infective trypanosomes, characteristic of *T. lewisi*, in the faeces on all occasions. The author argues that the flagellates were not destroyed because they were living on their true host. Patton has shown that the natural *Herpetomonas* of *Culex fatigans* disappears from the insect when it has a feed of blood, probably because, being really a flagellate of the larva of the mosquito, it finds itself in an unnatural environment.

Miss Robertson has found that batches of *Glossina* fed on cases of human trypanosomiasis show a greater percentage of individuals infected if they have had only a single feed of blood. The explanation in this case is not clear, as it is known that an infected *Glossina* may infect a series of animals at intervals of several days. Patton regards this effect of a second feed of blood as explaining the tendency of kala azar to remain localised in Madras and Oriental sore in Cambay. But this assumption contains a fallacy. It is not as a rule the intermediate host which transports the infection from place to place, but the reservoir (frequently man himself) that travels about to places in which the intermediate host is to be found. Trypanosomiasis, yellow fever and malaria are carried about by the moving reservoir —Man—not by *Glossina*, *Stegomyia* and *Anopheles*; and plague is carried by rats. This appears to be a far more reasonable view of the means of dispersal of kala azar and Oriental sore. The intermediate host may of course be transported, but this is a mode of spread quite subsidiary to that caused by the movements of man himself.

Experiments on the development of Leishmania tropica *in* Cimex lectularius.

The author produced in himself Oriental sore by inoculation in Aleppo in August, 1911. Six and a half months later 3 sores (non-ulcerating) appeared. Of 105 bugs, bred in the laboratory and allowed to feed on the thin red epidermis over the sore, only 3 gave positive results. These were dissected only 2 or 3 days after feeding; the others 4-9 days after. The author regards the results as practically proving that no active multiplication of the parasite took place.

The flagellates found resembled those of artificial cultures and the author is of opinion that the failure to develop beyond a certain point was due to failure of nutriment; as in exhausted culture media round or non-flagellate forms are found, so in the bug they appear when the blood is nearing the completion of digestion.

Experiments conducted with Fleas.

The author describes in detail Nöller's method of handling and feeding fleas for experimental purposes and then gives an account of the results of his own experiments.

Fleas which yielded negative results when fed upon uninfected persons were fed on the author's own sore and then found to pass free parasites in their faeces. All possibility of confusion with any *Herpetomonas* of the flea itself would thus appear to be removed. As the result of a number of careful experiments with *Ctenocephalus canis* (the dog flea) and *Pulex irritans* the author arrived at the following conclusions:—

1. That the dog and human fleas, *Ctenocephalus canis* and *Pulex irritans*, readily take up *Leishmania tropica* from the sore and that some of them are passed in the faeces voided during the act of feeding.

2. That if a flea is infected with flagellates the faeces voided during the feed will contain some of these.

3. That the *Leishmania* taken up do not develop into flagellate forms or produce an infection of the flea's gut.

4. The fleas that have not become infected with *Leishmania* may be infected with *Trypanosoma lewisi*.

5. When once infected with *Herpetomonas* or *T. lewisi* the fleas remain so infected for long periods whether they feed upon human or rat's blood. The human blood appears to be quite favourable to the development of *T. lewisi* in the flea.

6. *T. lewisi* appears to undergo its development in *Pulex irritans* as well as in the dog-flea, *Ctenocephalus canis*.

7. As Nöller has shown, it is the faeces passed by the flea which, when licked up by the rat, produce an infection. The act of feeding itself apparently does not infect. This has been confirmed by feeding the dog-flea on a *T. lewisi* rat, feeding it subsequently on a second rat, and giving the faeces passed during the feed to a third rat. It is only the third rat that becomes infected. The incubation period was six days in the rat.

8. The small oval encysted forms of the *Herpetomonas* passed by the flea are very resistant structures. They will withstand drying for 24 hours, and then give rise to a culture of *Herpetomonas* when introduced into NNN medium.

The author thinks that, inasmuch as the flea may contain a natural *Herpetomonas* almost indistinguishable from cultures of *Leishmania*, Basile and those who have followed him may have misinterpreted what they found in fleas. The number of fleas found by Basile to be infected with what he regarded as *Leishmania* was well below the percentage found in other places to be naturally infected with *Herpetomonas*. The *Herpetomonas* found by the author in fleas corresponds entirely with those described by Basile and Alvarez and Pereira da Silva. The author's flea experiments were made with *Leishmania tropica* and Basile's with the *Leishmania* of infantile kala azar and it may be urged that the results are not comparable. *Leishmania* derived from all sources behave so similarly in culture media and in bed-bugs that if one develops in such a host as the flea it would be expected that the other would at least show some indication of such a development.

He is in accord with Nicolle and Basile that the kala azar of the Mediterranean districts is the same disease in children as in dogs. Patton and Gabbi regard them as distinct, but the fact that the two occur together in all the endemic centres is in itself almost convincing. The fact of a child, a dog and a cat being found all infected on an isolated farm near Algiers and that kala azar may be produced in dogs by inoculation with the human virus, seems to be all but proof that the two forms are identical.

The distribution of the Mediterranean kala azar in children and dogs points to the flea as a likely transmitter of the malady. The mosquito may be the transmitter, as it feeds both on dogs and man. The author thinks that in India the bed-bug may be the carrier, but until the experiment of transmission has been carried out, we must be content to keep an open mind upon this subject.

STANTON (Dr. A. T.), Bacteriologist, Institute for Medical Research, Federated Malay States. **The Anopheles Mosquitos of Malaya and their Larvae, with some Notes on Malaria-carrying Species.**—*Jl. Lond. Sch. Trop. Med.* II., part I. Dec., 1912. pp. 3-11.

Since the publication of the monograph by Drs. G. F. Leicester and C. W. Daniels on the CULICIDAE of Malaya in 1908, several new observations have been made which appear to be of sufficient value to justify a revision of the group of Malayan *Anopheles*. An examination of specimens from different countries in the Oriental region and of the types preserved in the British Museum of Natural History has shown that much confusion still exists in mosquito nomenclature. In certain cases the same mosquito is known under different names—for example, *fuliginosus* of India is identical with *nivipes* of Malaya; while in other cases different mosquitos are known under the same name—for example, *willmori* of Malaya (Leicester) is different from *willmori* of India (James and Liston). One regretable result of this confusion is that the knowledge gained of malaria-carrying species in one country is rendered valueless in its application to the circumstances of the other.

The present paper embodies the results of a study of a large series of Malayan *Anopheles* and comparison of these with specimens of the Indian species and with the type specimens in the British Museum. The individual species are not described, but a table is appended showing how those may be recognised which are considered to be of undoubted validity.

The species recognised, with their synonyms, are as follows:—

Anopheles aitkeni, James, 1903.
  Stethomyia fragilis, Theobald, 1903.
  Anopheles treacherii, Leicester, 1908.
  Neostethopheles aitkeni, James & Liston, 1911.
Anopheles umbrosus, Theobald, 1903.
Anopheles asiaticus, Leicester, 1904.
Anopheles albirostris, Theobald, 1903.
Anopheles rossi, Giles, 1899.
Anopheles ludlowi, Theobald, 1903.
Anopheles tessellatus, Theobald, 1901.
  Anopheles punctulatus, Theobald (*nec* Dönitz), 1901.
Anopheles leucosphyrus, Dönitz, 1901.
  Myzomyia (?) elegans, James in Theobald, 1903.
Anopheles maculatus, Theobald, 1901.
  Nyssorhynchus willmori, Leicester (*nec* James), 1908.
  Nyssorhynchus pseudowillmori, Theobald, 1910.
Anopheles nigrans, nom. nov.*
  Nyssorhynchus karwari, James in Theobald, 1903.
Anopheles fuliginosus, Giles, 1900.
  Anopheles leucopus, Dönitz, 1901.
  Anopheles jamesii, Liston, 1901.
  Nyssorhynchus nivipes, Theobald, 1907.
Anopheles sinensis, Wiedemann, 1828.
  Anopheles jesoensis, Tsuzuki, 1902.
  Myzorhynchus peditaeniatus, Leicester, 1908.
Anopheles barbirostris, Van der Wulp, 1884.
Anopheles albotaeniatus, Theobald, 1903.
Anopheles kochi, Dönitz, 1901.
  Christophersia halli, James, 1910.

Alcock (A.), C.I.E., F.R.S. **Description of a new species of *Anopheles* from the Malay Peninsula.**—*Jl. Lond. Sch. Trop. Med.* II. Dec. 1912. pp. 1-2. (2 figs. in text.)

Two specimens of a remarkable species of *Anopheles* have been bred by Dr. A. R. Wellington from larvae found in a reservoir of drinking water in the Larut Hills in the Malay Peninsula, at an elevation of 4,000 feet and quite close to jungle. The new species, described as *Anopheles* (*Myzorhynchus*) *wellingtonianus*, has many points of resemblance both to "*Lophoscelomyia*" *asiatica* and to *Anopheles* (*Myzorhynchus*) *barbirostris*. It certainly supports the opinion that, whatever view be taken of the limits of the genus *Anopheles*, all these three species are congeneric.

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* [According to the generally accepted rules of entomological nomenclature this species should stand as *Anopheles karwari*, James, there being no necessity for a new name.—Ed.]

CARTER (H. F.). **Descriptions of Three New African Species of the Genus** *Tabanus*.—*Ann. Trop. Med. & Paras.* VI. No. 4. Dec. 1912. pp. 435-442. 1 plate.

The species described are as follow:—

(1) *Tabanus ngamiensis*, sp.n. Habitat: Ngamiland, S. Africa; Dr. W. R. W. James, 10.xii.1910; fourteen females. Somewhat resembles *Tabanus diversus*, Ric.

(2) *Tabanus fulvicapillus*, sp.n. A large dark species, closely related to *Tabanus trigonus*, Coq. Habitat: Banana, Congo Free State; Dr. Etienne; two females. This very striking species cannot be mistaken for any other hitherto recorded from the African Continent.

(3) *Tabanus donaldsoni*, sp.n. Habitat: Bromassi (two hours from Coomassi), Ashanti, W. Africa; Dr. A. S. Donaldson; one female. Three further examples from Dr. J. B. Adam, Calabar, S. Nigeria.

The types of all three species are in the collection of the Liverpool School of Tropical Medicine.

GUITERIS. **Bubonic Plague in Havana.**—*Jl. Am. Med. Ass.* Nov. 16, 1912. (Abstract *Jl. Trop Med.* 1st Jan., 1913.)

The author reports 3 cases, describes the present sanitary conditions of the city and says that they are favourable for the control of the disease. In the laboratory 8,909 rats were examined and none were found to be infected with plague. The author says that Kitasato has drawn attention to the fact that it is not rare to have summer epidemics of plague without finding plague rats. Another point in favour of the disease being rapidly stamped out was that it appeared in summer, a time when the flea population of rats is at its lowest in the tropics. The author has bred *Xenopsylla cheopis*, the common rat flea of Havana, for several years, and the decrease in their numbers in summer has been very striking.

GORGAS (Colonel). **Sanitary Organisation of the Isthmian Canal.** *Journal of the Association of the Military Surgeons of the U.S.* (Reviewed in *Jl. Trop. Med. & Hyg.* XVI. Pt. 1. 1st Jan., 1913. pp. 4-5.)

The writer describes the Sanitary Organisation of the Isthmian Canal, especially in its bearing on anti-malarial measures. The Canal is the centre of a strip of land 10 miles wide and 45 miles in length from north to south. The population to be protected against malaria consists of about 50,000 labourers and their families and is scattered all over the 500 square miles, though perhaps more concentrated on the line of the Canal and especially in some 40 camps and villages near this line. The local climatic conditions are such that mosquitos will breed freely all the year round and even in the four months in which there is practically no rainfall. The differences in the level of the land through which the Canal passes do not affect the question, as there is water enough on the high ground for the breeding of *Anopheles.*

During the 5 years of the American occupation, 250,000 persons have been brought into the area and the author thinks that the experience of Panama may be useful in the military occupation of tropical countries.

Anti-malarial measures consist of:—(1) destroying the habitat of the *Anopheles* during the larval stage within 100 yards of dwellings; (2) destroying within the same area all protection for the adult mosquito; (3) screening all habitations so that mosquitos cannot have access; (4) where breeding-places cannot be done away with by draining, use is made of crude oil (Phinotas oil and sulphate of copper) for the destruction of larvae.

These measures are based upon the knowledge that the *Anopheles* larvae only live as a rule in clear fresh water in which there is a plentiful supply of grass and algae, and that the adult is weak on the wing, does not fly far, and needs an ample supply of grass and brushwood for protection against wind.

In order to carry out these measures the 500 square miles was divided into 17 districts each under the charge of a Sanitary Inspector with the necessary clerks and 3 assistants, one of whom was competent as to mosquitos, another as to ditching and draining, and a third in general executive work. Each of the districts has an inspector in charge, with 40 or 50 labourers to ditch and drain, carpenters to keep the screening in repair, and one or two quinine dispensers, who were kept constantly going round giving 3-grain doses of quinine to those who wished it. No compulsion was exercised in this matter.

The district physician reported daily the number of cases of malaria to the central office which made a weekly report on the whole area, a copy of which was sent to each district inspector who was held responsible for any excess of malaria in his district; thus, if the rate rose during the week above 1½ per cent., something was considered to be wrong and the assistant to the Chief Sanitary Inspector was sent to the district to enquire into the cause.

In order to do away with breeding-places of larvae tiled drains were put down wherever suitable. The author considers this the most effective and economical form of drainage, as once done it requires no further attention, affords no breeding-place for mosquitos, and a machine or scythe can be used for cutting the grass over it. Where this plan was not possible, open concreted ditches were adopted. These are objectionable because they require constant sweeping and cleaning in order to prevent the formation of little puddles of water in which the mosquitos will breed. If neither of these ways could be adopted, then open ditches were dug, but this is the least effective and most expensive form of drainage. They fill up quickly with grass and have to be cleaned out once a fortnight.

In order to destroy cover for the adult mosquito, the ground was cleared of brushwood and grass for 100 yards round the place to be protected. If the locality was to be occupied for a year or more it was more economical to level the ground and plant grass which could be kept down by machine or scythe. A limited amount of shrubbery or a few trees near a dwelling are allowable.

The author emphasises the necessity of constant supervision of screens, the use of good material and good workmanship, as, if properly made in wire, they will last 3 years. There are plenty on the market that will not last six months.

Prophylactic quinine was supplied in 3-grain doses, either in solution, as a tonic, or in pills. It was placed on the table at all the messes and given to any employee who applied for it. The three dispensers of each district also went round to the villages offering quinine to all who would take it. In this way about 20,000 doses were supplied daily to a population of 45,000.

The author regards prophylactic quinine as a most important measure. Phinotas oil and copper sulphate were used in places which could not be drained; oil for temporary pools on construction work, or in temporary camps where drainage would be too costly, or in any place in which drainage was not carried out. It was also used for killing larvae in the algae and grass along the edges of lakes, swamps or streams. Sulphate of copper was used in the same way.

The author considers that the only practical protection for troops on the march in a malarious country is prophylactic quinine. Real exposure to malarial infection can only occur in a town. With a fresh camp every night it is probable that such *Anopheles* as bit the men would not be infected. If one camp were used for a week or more the ground should be cleared and drained.

Col. Gorgas is very strongly of opinion that the sanitary officer should himself have the superintendence of this work; that is to say, it must be done by a man who understands why it is done in order that it may be done properly. With the spread of knowledge the engineer, quarter-master or provost of the camp might be entrusted with the work; but it should be a *sine quâ non* that the sanitary officer should be held responsible; he must therefore have an immediate control of the working force. If this is not the case the work is foredoomed to fail.

BREINL (A.). Director, Australian Inst. Trop. Med. **Report on Health and Disease in the Northern Territory.**—*Bulletin of the Northern Territory*. No. 1a. July, 1912. pp. 10-24.

Cases of malaria in the Northern Territory of Australia vary greatly in number from year to year. The average number of cases of malaria treated in the hospital at Darwin for the years

1897 to 1906 inclusive was six, from 1907 to 1910 twenty-three. The most severe epidemic of recent years occurred in 1905. During a journey made by the Medical Officer, throughout the Territory, blood-smears were taken from as many suspected sufferers as possible in order to obtain an estimate of the general prevalence of the disease. The mining camp at Umbrawarra Creek, 13 miles south of Pine Creek was visited, and numbers of the miners found to be suffering from fever. All about the camps were pools of stagnant water, often swarming with fish; others barely a square yard in area and several inches deep were filled with decaying vegetable matter. These were simply abounding in mosquito larvae and pupae. The dry season (May to September) is considered the worst season for fever. All the men in this camp were either suffering or had suffered from fever, and in some cases the number of parasites found in the blood was very great. Two of these men had come from New Guinea where they had contracted the disease. The New Guinea type is characterised by the extreme severity of the first attacks, and if the sufferer does not succumb at this period he becomes more or less immune to the action of the parasites. If no re-infection occurs the patient lapses into the chronic stage of the disease and is a constant source of danger to his neighbours. The probability that malaria has been introduced in this manner from New Guinea is very great, as the Umbrawarra fever is of the same type as that in New Guinea, and mosquitos capable of transmitting malaria are found in great numbers.

Anopheles (*Nyssorhynchus*) *annulipes* is probably the distributing agent. Numerous larvae and pupae were collected from the water-holes and the adult insects bred out and identified. It has been proved by Kinoshita, in Formosa, that this species of Anopheline is capable of transmitting malaria. Preventive measures suggested are:—(1) removal of the camp to a distance of at least half a mile from the river; (2) regular oiling of the pools; (3) compelling the miners to take quinine during the fever season, about 15 grains twice weekly, and to sleep under mosquito nets.

Several other mining camps were visited and in all of them cases of fever of a similar type to that of New Guinea were found. Several of the miners affected had come from New Guinea. Mosquitos were found in all these stations.

The Medical Officer is of opinion that the evidence of importation of the fever and its subsequent distribution by the local mosquito is conclusive, and that if the population increased so would the malaria spread, owing to the presence of already infected persons.

The "wild" aborigines were found to be free, but those employed on the stations were subject to fever. The Medical Officer suggests that a blood examination of new-comers, and action taken upon it, might materially assist in keeping down the disease, and that the miners and the children in the public schools should be taught the history of malaria and the general principles of the means of prevention.

It is interesting to note that one or two new species of mosquitos belonging to a genus prevalent in the East and Malay States were found in the Northern Territory. This seems to point to the fact that an introduction of insects from the East is taking place.

TAYLOR (F. H.). **Description of Mosquitos Collected during the Expedition of 1911.**—*Bulletin of Northern Territory.* No. 1a. July, 1912. pp. 25-36.

The following is the list:—

Anopheles (*Myzorhynchus*) *bancrofti*, Giles.—Common.
Toxorhynchites speciosa, Skuse.—1 at Darwin.
Mucidus alternans, Westw.—1 at Darwin.
Stegomyia fasciata, F.—12, all at Darwin.
Culex quinquevittatus, Say (*fatigans*, Wied.)—12 at Darwin.
Culex parvus, sp. n.
Culex palpalis, sp. n.
Culicelsa annulirostris, Skuse.—Specimens taken closely resemble both Skuse's and Theobald's descriptions but may prove to be a distinct species.
Culicelsa ? alboannulata, Macq.—1 damaged specimen.
Culicelsa albirostris, Macq.—1 damaged specimen, probably of this species.
Chrysoconops acer, Walk.—Widely distributed from Darwin to New Zealand.
Mansonioides (*Mansonia*) *uniformis*, Theo.—From 6 localities.
Danielsia minuta, sp. n.
Danielsia alboannulata, sp. n.
Aëdomyia venustipes (?) Skuse.

Dr. C. L. STRANGMAN, in charge of the expedition, collected a number of ticks infesting the Brama cattle. All were found to agree well with *Boophilus australis*, Fuller, the Australian cattle tick, as described and figured by Salmon and Stiles, Bureau, Animal Ind., U.S.A. Ann. Rep. 1900, p. 426.

HESSE. **Parasitic Mould of the House Fly.**—*Brit. Med. Jl.* 4th Jan. 1913. p. 41.

Mr. Hesse a year or two ago began the investigation of *Empusa muscae* and in the beginning of July last sent to the Local Government Board a sample of what he believed to be a successful attempt to cultivate this organism. The Board caused the specimens to be examined by Dr. J. Bernstein, who reported that the organism present was, in fact, *Empusa muscae*. In the same month Mr. Hesse succeeded in killing 3 species of fly, *Stomoxys calcitrans*, *Musca domestica* and *Fannia canicularis*, by feeding them on food impregnated with this artificial cultivation, (the first of these facts was recorded by Mr. Hesse in the English Mechanic and World of Science for 12th July, 1912, and a somewhat inaccurate version of this communication was published shortly afterwards in the American press).

Since then Mr. Hesse has gone further by poisoning manure with the artificial cultivation and attempting to develop the fly larvae therein. The result was encouraging. The larvae assumed the pupal form but did not hatch out. A further experiment by Mr. Hesse tends to show that the zygospores if swallowed by the fly when disseminated in syrup, are thrown off as conidia by the fly, thus completing the life-cycle of the fungus. The interest of these observations lies in the fact that hitherto the spores have been supposed to work their way into the fly through the surface of its abdomen, whereas it would now appear from Mr. Hesse's experiments that they are swallowed and probably germinate in the crop.

MARTIN (C. J.). **Horace Dobell Lectures on Insect Porters of Bacterial Infections, delivered before the R. Coll. of Physicians.** —*Brit. Med. Jl.* 4th Jan. 1913. pp. 1-8; and 11th Jan. 1913. pp. 59-68.

In the first of these lectures the author deals with the house-fly, and discusses the evidence which exists as to the carriage by this insect of various epidemic disorders, especially typhoid and infantile diarrhoea. In the second lecture the rat flea, as the carrier of plague, and the human flea are discussed. The reason why the human flea is ineffective in the transmission of plague, is because in human cases the average degree of septicaemia before death is so much less than in rats that the chance of a flea imbibing even a single bacillus is small. Possibly in the middle ages when the intensity of the septicaemia in man may have been greater the human flea may have played its part in carrying infection.

Typhus, relapsing fever and poliomyelitis may be transmitted by insects. Typhus fever has been shown to be capable of transmission by the agency of body lice by Nicolle, Compte and Conseil (1909) and by Ricketts and Wilder (1911). The last insect dealt with in the lectures is the bed-bug, of which the author says, there is no real evidence to incriminate this insect in the case of either typhus or relapsing fever. Plague has been transmitted experimentally by bugs but there is no epidemiological reason for supposing that this takes place to any extent in nature.

The report of these lectures is very fully illustrated with drawings of the mouth and other parts of the insects named and a very full bibliography is given.

MITZMAIN (M. B.). **Collected Notes on the Insect Transmission of Surra in Carabaos.** *Philippine Agric. Rev.* (*Vety.*). V. No. 12. Dec. 1912. pp. 670-681.

Experimental Transmission of Surra by Lice.

The Carabao is a variety of the Indian buffalo (*Bubalus. bubalis*) and is commonly regarded as being indigenous to the Philippines. The author's first enquiry was into the dispersal of the lice of this buffalo and their *rôle* in the transmission of *Trypanosoma evansi*. The transmission of *T. lewisi* by the agency of lice has been effected by many workers, but it does not appear that *T. evansi* has been experimentally transmitted. Observations were made on four beasts, two had been kept for 3 months in screened stalls and two others in a separate shed, but not screened. The blood was regularly examined, the temperature taken and guinea-pigs inoculated with the blood. At the end of 6 weeks, neither buffalos nor guinea-pigs showing any trace of trypanosomes, the former were regarded as suitable for observation. On 12th Dec. 1910, a thousand lice (*Haematopinus bituberculatus*, Nitzsch) were collected from a carabao heavily infected with trypanosomes. These were divided into five lots of 200 each; one lot was set aside as a control, but all died within 3 days. Two hours after removal from the infected host one lot was placed on the hair of carabao No. 8 (screened stall) and 10 hours later another lot on carabao No. 7 (screened stall). Twenty-four hours after removal from their infected host a lot was placed on carabao No. 16 (unscreened stall) and the next day carabao No. 17 (unscreened stall) received the last lot of lice. The beasts were then all segregated in fly-screened stalls. All remained normal till 3rd Jan. 1911, 22 days after introduction of the lice, when No. 8 became feverish and the blood showed trypanosomes (1 per 50 fields, 1-12th obj.). A guinea-pig (A1) was inoculated with 3 cc. blood from the ear of this carabao and daily blood examinations were made. On 9th Jan. No. 8 which had remained normal since the last rise now registered 40·2 C° (104·3 F°). On 10th Jan. a native horse and two guinea-pigs were inoculated with its blood and 8 days later the horse showed trypanosomes in its blood. The blood of guinea-pig A1 though examined daily showed no trypanosomes until 21 days after inoculation. The others inoculated with the horse showed them in 10-12 days. The other three carabaos after a month showed no signs of infection, either by temperature or blood tests.

How far the lice may act as carriers of surra the author is not prepared to state. It would seem that they must find a new host within a few hours of the death of the previous one and begin their attack almost at once. The lice have been observed not to change their position until the body of the dead host has become quite cold. The quantity of hair on the beast is an important factor, old animals shed much of their hair and therefore have few lice. The author thinks that where beasts are confined in considerable numbers, *e.g.*, in quarantine, and contact is probable, exchange of lice may take place to a considerable extent. Beasts that have ample opportunity of bathing and wallowing have fewer lice than others. The author cites cases of Indo-Chinese bullocks dying of surra and infested by lice undistinguishable from those of the carabao. Experiments are being made as to the possible transmission of carabao lice to this variety of bullock.

Transfer of the Lice by Flies.

The carabao louse has been found attached to the legs of a species of *Lyperosia*, common in the islands, on an average of one in three, 1,800 flies collected in five days yielding 620 lice. This lasted till the middle of March, when the *Lyperosia* gradually disappeared and the stable-fly, *Stomoxys calcitrans*, predominated in vast numbers. The louse was never found attached to the latter nor indeed to any other species than the *Lyperosia*. The parasite in question was undoubtedly the larval form of the carabao louse. No other species was collected from carabao on which the infested flies were found. None of the lice found on the flies had imbibed mammalian blood. How far the flies may act as distributors of the lice is unknown, but it seems probable that they can and do act as such.

An Experiment to demonstrate Periods of Non-infectivity in Carabaos affected with Surra.

An emulsion of 150 *Lyperosia sp.*, which had bitten a surra carabao on a day when its blood was negative, when injected into a horse and two guinea-pigs gave no reaction, but an emulsion made from flies collected on the same carabao when positive gave a definite surra reaction. The author argues that if the blood of the animal had been used in place of the fly emulsion the result would have been the same. From the results of a number of experiments in blood inoculation the author concludes that, (1) during the negative stage of the disease the carabao is not a source of danger as an active focus for fly dissemination; (2) it does not become imperative to verify microscopical findings (when carefully performed) by animal inoculation in suspected cases of surra in carabaos, for it is not convincing or significant during negative periods; (3) when the trypanosome is not found during protracted stages upon microscopical examination it should not be assumed that the animal is free from infection.

Entomological study of a Surra Outbreak among Carabaos in the region of La Carlotta, Occidental Negros.

Investigations at 7 haciendas:—

(1.) 105 cattle, 115 carabaos, 6 horses; all permitted to pasture together freely; 8 cases carabao surra and 1 bullock, horses free. Over 80 per cent. of the flies found were common to all three kinds of animals and were all *Lyperosia*.

(2.) 90 cattle, 60 carabaos; 1 horse affected with surra, but had come from a farm close by only 4 weeks before. The flies collected were all *Lyperosia;* no *Stomoxys* whatever.

(3.) Indo-Chinese bull badly infected, 50 carabaos, in same pasture, free; few *Stomoxys*, dense swarms of *Lyperosia* around the bull, which also yielded carabao lice.

(4.) 90 carabaos (12 infected), 2 mares with colts, free. Sire of these colts infected and had been removed to a surra-free hacienda a mile away. Did the horse contract surra from the carabao?

(5.) 23 cattle, 53 carabao, all healthy; lice almost absent; good mud wallows. No TABANIDAE; *Lyperosia* present, with about 1 per cent. of *Stomoxys*.

(6.) 103 carabaos—6 surra cases and 12 suspects; no trypanosomes. More lice than at farm No. 5. *Lyperosia* predominated; few *Stomoxys*.

(7.) Herd of carabaos, 8 per cent. infected with surra, 5 positive on day of inspection. Flies collected, *Lyperosia* 341; *Stomoxys* 7; non-biting Muscids 7. *Lyperosia* vastly predominant.

The distribution of *Lyperosia* and *Stomoxys* on cattle, carabaos and horses during two weeks of field observation was cattle (70 per cent. and 10 per cent.), carabaos (95 per cent. and 3 per cent.), horses (25 per cent. and 70 per cent.). Tabanids were found on cattle only, 3 per cent.

The flies, several hundred *Lyperosia* together, travel with their host and serve as carriers. They have been observed to hold on to one animal for several kilometres; when the animal rests they are switched off and seek new hosts.

An experiment was made by shutting up a healthy carabao with two infected ones in a fly-proof cage, the animals not being in contact. About 5,000 *Lyperosia* flies were collected from healthy working carabaos and let loose in the shed containing the three animals. Daily observation of all three gave negative results. Further like experiments are in progress.

CASTELLANI (A.) & HIRST (S.). **Note on Copra Itch with a Report on the Mite causing it.**—*Jl. Trop. Med. & Hyg.* 16th Dec., 1912.

Dr. Castellani has observed for several years that persons employed in copra mills in Ceylon are subject to a peculiar eruption. The skin of the hands, arms and legs, and sometimes the whole body, except the face, is covered with fairly numerous, extremely pruriginous papules; papulo-pustules and pustules are also generally present. The eruption begins as a rule on the hands and thence spreads to the arms, legs and trunk; never to the face. The author found acari-like parasites on a patient's arm and was told by him that these were common in the copra dust. A sample of dust brought by the patient for examination was found to be swarming with similar acari. These have now been identified by Hirst as a new variety of *Tyroglyphus longior*. The mite does not bury itself in the skin, but appears to induce dermatitis in the same manner as *Pediculoides ventricosus* (Newport), which lives in diseased cereals, but further investigation is necessary.

The author has produced the disease experimentally by rubbing copra dust containing the mite on to the skin of healthy persons.

Itching begins shortly after and the eruption develops in 24-48 hours. Another trial was made in the same way with mites picked out of the dust and with the same result. Some persons appear not to be affected by it. The eruption heals spontaneously as soon as the subject of it ceases to handle copra. Beta-naphthol ointment (5 per cent to 10 per cent.) has proved very useful in treatment.

Hirst describes the mite under the name of *Tyroglyphus longior*, Gerv., var. *castellanii*, var. nov.

Parallel cases of eruptions caused by mites are to be found in Growers' itch caused by *Glycyphagus domesticus*, Gerv., and the water-itch of coolies on the Indian tea plantations, a serious complaint caused by *Rhizoglyphus parasiticus*, Dalgetty.

LEIPER (R. T.). **Metamorphosis of** ***Filaria loa.***—*Brit. Med. Jl.* 4th Jan. 1912. pp. 39-40.

Dr. Leiper telegraphed from Calabar, Southern Nigeria, on the 27th Sept. 1912, to the London School of Tropical Medicine that he had proved that the metamorphosis of *Filaria loa* takes place in the salivary glands of a fly belonging to the genus *Chrysops*. The diurnal periodicity of the embryos of this *Filaria* had suggested that the intermediate host was a day-biting insect, and this now appears to have been established by Dr. Leiper.

The importance of the discovery lies in the fact that it will now be possible to determine the conditions under which human beings become infected, and gives ground for hope that means for the prevention of such infection will be found. The members of the genus *Chrysops* are day-biting flies, and are very widely distributed not only in the tropics but also in temperate climates, even in the British Isles. Dr. Leiper is expected to be able to show which species of *Chrysops* is the carrier, as it is known that *Filaria loa* is limited to West Africa.

[The only species of *Chrysops* known from Southern Nigeria are *C. dimidiata*, Wulp, *silacea*, Aust. (probably a colour variety of the preceding), and *longicornis*, Macq., the two former being abundant, especially in the Eastern Province, while *longicornis* is comparatively scarce.—Ed.]

ROSENAU (M. J.) & BRUES (C. T.). **Some experimental observations on Monkeys concerning the transmission of Poliomyelitis through the agency of** ***Stomoxys calcitrans.***—*Mthly. Bull. State Bd. of Health, Massachusetts*, N.S. VII. No. 9. Sept. 1912. pp. 314-317.

The authors make a preliminary report on work still in progress.

Twelve healthy monkeys were exposed to the bites of *Stomoxys calcitrans* which had had abundant opportunity of biting infected monkeys, with the result that three of them acquired the disease in a virulent form, resulting in death; three were slightly infected, and the remaining six escaped.

Harvard Alumni Bulletin. XV. No. 9. Nov. 20. 1912. pp. 140-142.

An account of the methods by which the discovery of Rosenau and Brues was reached is given in the above. Careful tabulation of cases of poliomyelitis in the State of Massachusetts showed that these occurred during the summer and early autumn, growing more frequent after the middle of the summer and lasting until well on towards cold weather. The number of isolated cases was so great that contact was soon seen to be at least an improbable means of transmission. The possibility of the existence of an insect carrier was then considered. Fleas and bed-bugs were ruled out because cases occurred in houses in which these insects were conspicuously absent. Other biting insects were excluded because no history of their presence was found.

The common stable fly (so-called in the U.S.A.), *Stomoxys calcitrans*, was the only one whose distribution agreed with that of the cases. Healthy monkeys were then infected with the disease, they having long been known to be subject to it. These were then allowed to be bitten by *Stomoxys* and a large number of the flies, presumed to have taken up the virus from the infected monkeys, were introduced into a suitable cage containing the 12 monkeys referred to in the previous abstract; six of these became infected and exhibited the symptoms of the disease. Further confirmation was obtained by Drs. Anderson and Frost, of the Public Health and Marine Hospital Service at Washington, who infected another set of healthy monkeys with a culture from those bitten by the flies and reproduced the disease in them.

The normal food of *Stomoxys calcitrans* is blood obtained from various animals, but less commonly from human beings. Cattle and horses are chiefly attacked, and the flies are in consequence more common in the country than in towns. Each fly appears to feed once in every two or three days, perhaps oftener. They remain out-of-doors in fine weather and seek shelter in rain, but bite more commonly outside in bright sunny weather. *Stomoxys* appears early in the spring and becomes more abundant after midsummer, persisting after the house-fly has begun rapidly to disappear. The proboscis, which can be observed when the fly is at rest, distinguishes it at once from the house-fly, to which it has, for the ordinary observer, some superficial resemblance. The breeding habits resemble those of the house-fly. The eggs are laid in small masses in fermenting heaps of grass and straw, horse manure, cow dung and even garbage. Excessive moisture seems favourable to the development of the larvae. *Stomoxys calcitrans* is very widely distributed throughout the world, but is the only member of its genus in the New World. It has been known in America for a long period, and though possible, it seems hardly probable that it is an importation.

HOWARD (C. W.) & CLARK (P. F.). **Experiments on Insect Transmission of the Virus of Poliomyelitis.**—*Jl. of Exp. Med.* XVI. No. 6. 1912. pp. 850-859.

The authors made careful experiments with the house-fly, *Musca domestica,* and with mosquitos, *Culex pipiens* in two experiments, and in all others a mixture of 90 per cent. *Culex sollicitans* and 10 per cent. *Culex cantator*. Further experiments were made with lice, *Pediculus capitis* and *Pediculus vestimenti*, and with bed-bugs, *Cimex lectularius*. The conclusions arrived at were:—

(1.) *Musca domestica* can carry the virus in an active state for several days on the surface of the body and for several hours in the gastro-intestinal tract.

(2.) The species of mosquitos used did not take up and maintain in a living state the virus from the spinal cord of monkeys.

(3.) Lice, *P. capitis* and *P. vestimenti*, did not take the virus out of the blood of monkeys or maintain it in a living state.

(4.) Bed-bugs took the virus from the blood of infected monkeys and maintained it in a living state for a period of seven days.

Froggatt (W. W.). *Agric. Jl. of New South Wales.* xxiii. Nov. 1912. p. 952.

The writer recommends one part of formalin and 15 parts of water by measure, placed in a saucer, with a crust of bread sprinkled with sugar in the middle, as an excellent method of killing house-flies. In dealing with a room infested with flies he advises covering up all food and liquid, placing the saucer on a table on a sheet of newspaper or in the brightest place in the room, and the flies will soon die out.

Strickland (C.). **Half-Yearly Report of the Travelling Entomologist to the Federated Malay States.** Unpublished Report to the Secretary of State for the Colonies.

Mr. Strickland reports his intention of repeating experiments on the introduction of the small fish known as "millions" (*Poecilus poeciloides*) for the purpose of keeping down Anopheline larvae; a previous attempt having failed owing to lack of numbers. The question of the utility of Tuba root (the aerial root of *Derris elliptica*, one of the Leguminosae) as a larvicide is under investigation. It is much used by the Malays for killing fish; Dr. Daniels has already reported on it. A very detailed account is given of the distribution of Anopheline larvae in the neighbourhood of the hospital at Seremban. The species found were: *Anopheles separatus, barbirostris, karwari, kochii, sinensis, rossi, fuliginosus, palditaeniatus*, and three others not identified. The undergrowth in the neighbourhood of the hospital was suspected of contributing to the great increase of cases of fever in the 2nd, 3rd and 4th quarters of the years 1911 and 1912; but as a similar increase took place over the whole district, some general rather than a local cause must have been at work. General draining of all pools in which mosquitos might breed has been suggested, but the expense would be great, and Mr. Strickland appears to think that the drainage of the breeding places of known pathogenic species would probably suffice. The disease being more or less endemic, material for fresh infection is always at hand.

BEAL (W. P. B.). **Report Vet. Dep. Government of the Gold Coast for 1911-1912.**

Attention has been given to preventive measures against tsetse attacking horses, as the majority of horses contract trypanosomiasis on their journey down to Coomassie. The writer recommended arsenic (Orsudan grs. XX.) to be given on alternate days when horses are trekking through tsetse-fly country. Extra precautions have to be taken when going through notorious fly-belts, as the Makongo, Prang, Attabubu, and the *fusca* belt at Ejura on the Tamale road; and the Bole, Bampwe and Buka-Buka belts on the Wa-Kintampo road. Smearing the horses with a preparation of pounded tobacco rubbed down with Moshi butter is practised. This salve should be lightly applied over the whole body. The native practises a similar method, but he applies the preparation in the form of two crosses on each side of the quarters—probably this custom is of fetish origin—but the prophylactic qualities of the application undoubtedly consist of the strong odour which the dressing emits and its bitter properties.

Experiments were made on the administration of preparations of arsenic as prophylactics in a tsetse-fly district. The first was on 13 horses taken out to manoeuvres in the Tachimen district in February, March and April. One died on manoeuvres and 2 died at Coomassie from trypanosomiasis within a month of their return. This is reported to be the lowest rate of mortality recorded since officers took horses out on manoeuvres. The second experiment was tried from Accra. A horse was well drugged with arsenic and smeared and sent to work at Insuam on the Accra-Mangoase Railway. He worked 10 days carting. On return to Accra the blood was found to contain no trypanosomes. Both districts are notorious for tsetse-flies.

On the road from Coomassie to Salaga over 300 flies were caught. Fifty specimens were identified by Dr. Graham, of the Medical Research Institute, Lagos, as under:—

Glossina palpalis was found on the road at Ninting, Bosumcheche, Ejura, Prang, Yeji, and Makongo. *Glossina tachinoides*, was found from Ejura to Salaga; it is exceedingly common at Makongo. *Glossina fusca* was found between Bosumcheche and Ejura; this belt has extended down to Bosumcheche. *Glossina nigrofusca*, one specimen. *Glossina longipalpis* was found from Attabubu along the road to within a mile of Salaga.

MASON (F. E.). **Trypanosomiasis in Horses and Tuberculosis in Camels.**—Paper No. 5. 1912. Ministry of Interior. Dep. Pub. Health (Vet Sec.). Cairo. 1912.

There is a current belief among the Bedouins that occasionally horses become infected by means of biting flies (TABANIDAE) with the "fly disease" which so commonly attacks camels and that the condition always terminates fatally in a few months. During the fly season it is usual to see horses in Eastern Sharkia protected from the attacks of TABANIDAE by means of cloths. Mr. Littlewood informed the author that several years ago he saw horses showing symptoms similar to those of trypanosomiasis in camels which were pointed out to him by the Bedouins of Eastern Sharkia as having been "struck" by the fly. Piot Bey has made the same observation. The disease does not appear to be a common one, and the author, after searching for nearly 4 years, did not succeed in finding a case until 22nd October 1911, a chestnut arab belonging to the Khedivial Agricultural Society. Subsequently other cases were found in 3 police horses and another chestnut arab recently imported by the Bedouins.

LLOYD (L.). **New Nematode Parasite of** *Glossina morsitans.*—*Jl. Lond. Sch. Trop. Med.* II. Pt. 1. Dec. 1912. p. 41.

Mr. Lloyd writing from Mpika (3rd March 1912) as to a nematode which he has found parasitic in *Glossina morsitans*, reports the finding of four specimens in "wild" flies. He suggests that the worm will be of interest as throwing some light on the question of the food of this tsetse-fly. There are only two ways in which the parasite can obtain access to the fly, either from an animal, or from water. It is a disputed point whether *Glossina* takes up water. Dr. Kinghorn has observed *G. palpalis* settling on the edges of puddles near Lake Tanganyika, and Lloyd has seen *G. morsitans* doing the same on the Nyamadzi. *G. morsitans* will settle on wet blotting paper and thrust its proboscis into it, but Lloyd has never been able to prove by the use of coloured liquid that water was actually absorbed. The worm has been found in two flies only, out of about 300 wild flies dissected between September and March. In both cases during the last two weeks.

Dr. R. T. Leiper adds a note to the effect that the specimens are all immature adult examples of a species of *Mermis*, and resemble somewhat closely that found by Prof. Minchin a few years ago in *G. palpalis* in Uganda.

NOTICES.

The Review of Applied Entomology is intended to contain, month by month, abstracts of the latest information published concerning insects injurious to man or animals, as the carriers of disease; and to forests, fruit trees, crops or stored merchandise.

The Editor will be glad to receive prompt information of the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion, the adoption of which would increase the usefulness of the Review.

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Report of the Dept. of Agriculture, Nairobi, British E. Africa, 1911-12.

Tsetse-Flies.—Mr. C. A. Neave, the Chief Stock Inspector, reports that *Glossina longipennis* was the only species found in the country south of Marsabit. Though very troublesome, this fly does little damage to horses, mules, cattle, sheep or dogs, but trypanosomiasis in camels is frequent. The fly is prevalent, especially during the rains, around Marsabit, outside the forest and along the whole road to Uaso Nyiro.

Ticks.—*Amblyomma variegatum* and *A. hebraeum* are the most common species about Marsabit. They cause serious abscesses and those produced by the latter species are so large, hard and fibrous peripherally that they have to be dissected out. The lesions caused by the ticks afford entrance to the infection of epizootic and ulcerative lymphangitis. *Haemaphysalis leachi* is common on all dogs; *Rhipicephalus evertsi* about the anus of horses and cattle; *R. simus, R. decoloratus* and *R. appendiculatus* on horses and cattle. The acting chief veterinary officer at Nairobi reports that an *appendiculatus* which feeds as a larva on a sick animal is known to be capable of transmitting East Coast fever as a nymph; whether it can do so as an adult is uncertain and experiments have not been made, but there is no reason for supposing that it will behave differently from the same species in S. Africa. Experiments with *R. evertsi,* "the red-legged tick," have failed, and even in S. Africa, though often attempted, positive transmission is seldom effected. Attempts to get *R. pulchellus,* the common "yellow-backed tick," to feed upon cattle or other large animals, in the larval state, have failed, and though it will probably prove to be a carrier of East Coast fever, great difficulty has been experienced in obtaining natural cases of the disease in an infected area near the Athi River, where this tick abounds. Adult cattle in the most densely stocked districts in E. Africa, viz. Kavirondo, Kisii, Nandi, parts of Lumbwa and Sotik, and Mesu and Nyeri Kikuyu, as well as portions of Nairobi Kikuyu and Machakos appear to be immune or practically immune from East Coast fever. It has been shown that this is due to the recovery of the young animals and that those which reach maturity without contracting the disease succumb almost as readily as do grade stock. It would thus appear that either the young cattle possess a resistance to the disease which is lost later in life, or that the type prevailing in the districts referred to is milder than elsewhere. The resistance of newly born calves to local strains of the disease was tested and the mortality was high. Similar experiments with material of S. African origin resulted in the recovery of 6 out of 15, three of them half-breds; among those that died two were pure bred.

Identity of East Coast Fever in East and South Africa.—Three animals known to have suffered from East Coast fever and released as immune and two others believed to be susceptible were exposed to the attack of infected ticks received from Pretoria, equal numbers being placed on each of the five animals. The two beasts regarded as susceptible died; the other three did not show

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any reaction whatever. The trial was repeated with the same ticks on ten head of cattle, one of which was, as before, regarded as susceptible, and the other nine had been released from the Kamiti testing area as immune; the nine escaped, the other died. It seems therefore at least to be clear that an animal immune to East Coast fever is also immune to the S. African form and that therefore the diseases are identical.

BRAIN (C. K.). *Stomoxys calcitrans*, **Linn.**—*Ann. Entom. Soc. Amer.* (Columbus), v, pt. 4, pp. 421-430, 2 pl. 3 figs.

The author describes the distinctive characters of *Musca domestica*, L. (the House Fly), and *Fannia* (*Homalomyia*) *canicularis*, L. (the lesser House Fly) and of *Stomoxys calcitrans*, L. (the Stable Fly), discussing the internal anatomy of the last-named in detail. In one plate the three flies, their larvae and pupae are figured side by side.

WEISS (H. B.). **Notes on the Phototropism of Certain Mosquitos.**—*Ent. News, Philad.* xxiv, Jan. 1913, pp. 12-1.

Culex pipiens, *C. aurifer*, *C. canadensis*, *C. sylvestris*. *C. salinarius*, *Anopheles maculipennis* and *Wyeomyia smithii* appear normally only at night and are to a certain extent attracted by light of low intensity. Near the close of the season impregnated females of *C. pipiens* seek dark hibernating quarters in spite of outside warmth. *Aedes crucians* is a daylight mosquito, while *A. punctipennis* is attracted only by light of low intensity. *C. sollicitans* does not regard the light or its absence when seeking food. *C. perturbans* is not attracted by light, but *C. cantator* is attracted. Most of the salt-marsh forms seek the light, *e.g.*, *C. sollicitans*, *C. cantator* and *C. taeniorhynchus*; but *C. salinarius* does not. Those species which do not fear the light are the most active biters, although the light exposes them to the attacks of their natural enemies.

BALDREY (Major F. S. H.). **A Portable Spraying Apparatus for Ticks and Parasites on Cattle, and a Portable Bath for Foot-and-Mouth Disease.**—*Agric. Jl. of India.* vii, part 4, Oct. 1912, pp. 382-386.

The portable spray consists of an ordinary garden spraying hose for use with a bucket, with the usual iron stirrup attachment to enable the operator to use both hands. The rose sprayer is flattened, having 10-12 large holes and with a concave perforated surface so that the spray jets are concentrated when thrown on the body surface of the animal. Spraying is effected from the rear of the animal the fluid being thus forced *against the fall* of the hair and coming into direct contact with the skin. Cooper's Arsenical Dip is the fluid used. The animals are made to stand on a zinc lined tray so contrived that the waste dip is returned to a bucket sunk in the ground. The tray is made in two parts for convenience of transport.

Moss (C. J. A.). **Disease in Madagascar.**—*Jl. Trop. Med.* xvi, 15th Jan. 1913, pp. 17-23.

The author says that malaria is now a terrible scourge in Antananarivo and Imerina, though it was not so in the days of the Malagasy government. He attributes the change to two causes. Before the French occupation the Malagasy used to burn the long grass on the hillsides and along the streams; but as beacon fires were largely used by the natives in the early days of the French occupation of the island, the French authorities forbade the use of such fires and the firing of the grass, so that the shelter for the mosquitos was no longer destroyed and they consequently increased enormously in numbers. The second cause is, in the author's opinion, due indirectly to the levy of the poll-tax, as those natives who could not pay in money were made to pay in labour and were drafted to districts around Imerina for the construction of roads. These localities being often very malarious, the mortality was high, and the sick were sent back to their villages to become centres of infection. Changes are going on in the malarious character of certain villages for which no reasonable explanation is forthcoming, in that very unhealthy places have become almost healthy and *vice versa*.

Antananarivo stands on a hill with a large rice plain to the west of it, which exercises a most injurious influence on the health of the community. Undergrowth is cut down and the increase of the Cape lilac has been connected, wrongly in the author's opinion, with the increase of malaria. He suggests that the only practical plan for ridding the neighbourhood of mosquitos would be to close these rice fields for a time, the Government finding food for the people in the meanwhile and conducting a thorough and vigorous campaign against the mosquitos by every known means, until the area is cleared of them.

Laurie (D. F.). **The Poultry Tick.**—*Dept. of Agriculture, S. Australia, Bull.* No. 74, 1912, 32 pp.

The author points out that the majority of persons keeping poultry in infested localities are unaware that the ticks are present and that they are causing them much financial loss. Experience shows that most of the sickness occurring among poultry in the late spring, summer and autumn is due to ticks, and he advises that wherever poultry are found to be ailing, ticks should be sought for as the probable cause.

In 1907 the poultry tick was brought under the provision of the Stock Disease Act.

History of the tick in Australia.—There is no record of the date on which this pest was introduced into the State, and it is probable that it existed for some years before it was discovered to be a cause of loss among poultry. It has been stated that it was first introduced from South Africa, but the author is of opinion that it first came to Port Adelaide (it was first discovered there) with fowls brought from India. Complaints of losses by poultry breeders of Port Adelaide were made so far back as

30 years ago. It is also found along the Murray River, in the north of Victoria and other parts of that State, in New South Wales, Queensland, and Western Australia. In the colder and wetter districts the tick does not thrive. In the dry far North they multiply rapidly and live in comparatively exposed but dry situations. The habits of the tick in South Australia are very similar to those of the tick in South Africa and elsewhere.

In the author's opinion the Australian tick is *Argas persicus*.

The complaint is made that even experienced poultry breeders are very ignorant of the habits of the pest, even if their yards and houses are infested. Many do not even know its appearance, and others insist that in the larval form the tick is a distinct species from the adult which they term a "poultry bug," from its similarity in appearance to the ordinary bed bug. Many poultry breeders do not visit their fowl-houses at night; the tick is nocturnal in its habits, and although without apparent organs of vision, dislikes light and promptly retreats when the fowl-house is entered at night with a light. The adult tick is never found on poultry in the day time. The larval forms are very minute (·4 to ·5 mm.), almost colourless and easily mistaken for one of the small fowl mites with which they congregate in cracks and crevices. These larval ticks climb the perches and walls of the poultry-house and so reach the roosting fowls, to which they remain firmly attached until gorged with blood. In the day time they hide themselves in cracks and crevices, hence the practice of building poultry-houses of old timber is bad because the cracks afford shelter for the ticks.

The author remarks that the practice of building fowl-houses in contact with dwellings or outside domestic offices is thoroughly bad, in-as-much as houses and out-houses thus come to be badly infested. The presence of ticks can generally be detected in masonry and brickwork by the dark marks round the entrance to the cracks and holes caused by their excreta. Ticks may be carried about by the poultry themselves, by feathers used by other birds for their nests, by boxes, and even by agricultural machinery and vehicles. The author says that he once saw half a gallon of ticks shaken out of a stripping machine brought from a country town for repairs.

The regulations made by the South Australian Government as to the introduction of poultry or their removal from one place to another are quoted at length.

To eradicate the poultry tick.—As little woodwork as possible should be used in the construction of poultry-houses and it should be sawn and free from cracks. Galvanised iron makes the best house. In an infested yard the material of the old house should be burned and the ground on which it stood saturated with kerosene. This is important, as ticks have been known to take refuge in the soil when dry. If possible the new fowl-house should be erected on new ground. All perches should be so arranged as to be easily dismantled, so that the ticks may not lodge where two perches touch.

The author has for years recommended the free application of kerosene as a most effective agent for the destruction of ticks.

Boiling water is the favourite remedy, but usually long before the water reaches the tick it is almost cold. The mixture of one part of kerosene and nine parts of boiling soap-suds applied as hot as possible to cracks and crevices and woodwork generally is very effective. Oil added to the mixture improves it, because in combination with dust it clogs the breathing spiracles of the tick.

A table is given showing the results obtained by immersing live ticks in 21 different insecticide solutions, many of which show the remarkable vitality of the creature. It seems hardly credible that they should be able to resist immersion for 49 hours in a solution of corrosive sublimate, but according to the table such is the case.

The life cycle of the tick.—Ticks can live for long periods without obtaining blood from fowls and it seems probable that under these conditions they consume decaying vegetable matter. When feeding on blood in hot weather they feed about once a month and appear to require that period for the full digestion of their meal, after which they moult. The adult female tick begins to lay eggs about a week after she has fed, in small batches (20 to 100). Nuttall reported that it took 10 months to rear the ticks from egg-stage to egg-stage. Adult ticks apparently can travel great distances along fences and in this way may reach new fowl-houses.

Hosts.—Fowls are most commonly attacked. Turkeys roost on the tops of sheds and in high trees and escape as a rule, but if placed in a poultry-yard they are also attacked and often die. Ducks are not so subject to attack because they feed at night and are generally restless. Pigeons have been found infested, but as a rule they are free.

Cause of death in tick-infested poultry.—Many fowls die where comparatively few ticks are present, whilst others swarming with ticks do not die but only become emaciated and weak. In some cases where only two or three larvae were found attached to the bird and very few adults in the woodwork, the fowls died rapidly. From this it would appear that a large proportion of ticks do harm by simply sucking blood while others carry the spirochete (*S. marchouxi*).

Very few fowls recover from tick fever and in the hands of the ordinary breeder there is no known remedy, the disease not being discovered until much too late. For the practical poultry farmer undoubtedly the best, if not the only thing to do is to eradicate the tick.

KNAB (F.). **A Proposal for the Control of Certain Mosquitos.**—*Science*, xxxvii, 24th Jan. 1913, pp. 147-148.

Until about about 10 years ago Réaumur's account of the life-history of *Culex pipiens* was considered applicable to mosquitos in general, and it was usually supposed that in temperate regions all mosquitos hibernated in the adult female state, to deposit eggs and start a new generation with the return of warm weather. It is now known that this applies only to a very small number of species. The notion that swamps and bodies of stagnant water in general produce mosquitos throughout the warm months, is a misconception. The bulk of the mosquitos of North America are derived from larvae which develop in the snow-water in early spring and for a short period all the lesser bodies of water swarm with larvae, though none can be found in them during the remainder of the season. These larvae hatch from eggs deposited in the previous summer on leaves or rubbish in depressions of the ground. There is but one brood and the larval period is short, but the female imagos are long-lived (weeks and even months) and the egg-stage lasts through the winter to the following spring. The species hibernating as eggs and developing in the early spring (mostly of the genus *Aëdes*, Dyar & Knab) are numerous, and unless the oiling of their breeding pools be carried out exactly at the right time and on a very extensive and detailed scale, the work will be useless. The author thinks that the suggestion of Dr. Adolf Eysell is likely to be thoroughly effective if properly carried out, that is, the removal and burning, late in the autumn, of the old dead leaves and plant débris from the dried-out pools in which the larvae would appear later. Failing this, the leaves, etc., may be stacked on high ground where water will not collect; but the author regards the latter as an ineffectual method, since the amount of water required for the breeding of the mosquito is so small.

CLELAND (J. B.). **Injuries and Diseases of Man in Australia attributable to Animals (except Insects).**—*Jl. Trop. Med. & Hyg.*, xvi, No. 3, 1st Feb. 1913, pp. 43-45.

Human infection by ticks.—Along the east coast of Australia where there is dense scrub and tropical jungle it is not at all uncommon at certain times of the year to find that ticks (*Ixodes holocyclus*) attach themselves to man. The result is rarely anything beyond irritation, but occasionally, generally in children, severe symptoms have followed and even death; dogs and even pigs also suffer. Dr. Jos. Bancroft, of Queensland, writing as far back as 1884, says that these ticks often kill dogs and cats, though native animals endure them without much injury. A case is mentioned of a girl of 13 months old acquiring ticks from her father and others who carried her in their arms on returning from a walk in scrub infected with "bottle ticks" (*I. holocyclus*); the child fell ill and three days later a tick was found attached behind the left ear. The temperature rose to 101·6° F. and the pulse to 140 and the child appeared to be partially paralysed; death occurred on the day the tick was found. Another case of a man from whom 200 ticks were removed is cited; the symptoms were weak heart, collapse and syncope; the patient recovered under treatment.

Human Trypanosomiasis in Southern Rhodesia.—Unpublished Report, by the British South Africa Company, to the Secretary of State for the Colonies, 30th November, 1912.

The Medical Director to the British South Africa Company reports 10 cases of trypanosomiasis in the Sebungwe district—one of them a European. Eight of these cases are apparently traceable to a visit to, or a residence in, the valley of the Busi River, along the whole of which *Glossina morsitans* is prevalent. The area of infection is apparently confined to a strip of country about 14 miles long on this river, which is a tributary of the Sengwe. This part of the country is thinly populated and far remote from European settlement.

An attempt has been made by Mr. Jack, the Government Entomologist, to determine the boundaries of the tsetse area. He was not able to make any very extended observations, from want of time and owing to the dryness of the country, but it would appear that the eastern boundary of the area roughly coincides with the watershed between the Bume and Seseme Rivers; to the north it is bounded by the Sigilala Hills; while on the west the boundary runs from a point eight miles from the Zambesi to the Masunnu River, passing southwards to the Mlendi and Mzola Rivers. The fly does not come down to the point where the Mzola joins the Shangani and no fly is reported on the Shangani itself. The southern boundary could not be ascertained with any approach to accuracy; and from the point of view of the selection of the site to which the natives might be moved, this is not of much importance, because the whole district north of the Kana River is dried up for 40 or 50 miles.

Mr. Jack journeyed some 60 or 70 miles up the Kana, far beyond the point where the fly extends southward towards the Mzola, and found no fly.

MARETT (Capt. P. J.). **The Phlebotomus Flies of the Maltese Islands.**—*R.A.M.C. Journ.*, xx, no. 2, Feb. 1913, pp. 162-171.

Professor Newstead, of the Liverpool School of Tropical Medicine, has worked out the different species of the genus *Phlebotomus* found in Malta, but it is certain that other species exist in Gozo. One of these greatly resembles *P. papatasii,* and is similar, if not identical, with a fly found in Austria, but there is a variety found in Mostar which differs from the Malta species of that name in certain essential details, and it is possible that this difference in the species of fly accounts for the difference in the severity of the Maltese and of the Austrian sandfly fever respectively.

Life-history.—*P. papatasii* breeds in caves and in the recesses of embankments made of rocks and stones; disused chambers in the embankments to the fortifications, which have been partially filled with stones and rubbish, serve the same purpose. *P. perniciosus* and *P. minutus* breed chiefly in ordinary rubble walls and in the bastions, and also in the ground ventilators of buildings. The eggs hatch out in from 6 to 9 days. If kept somewhat dry they have been known to hatch 20 days after being laid. The period in nature has not been determined, as the eggs are too small to be found. The larvae live about 8 weeks in summer, but when the temperature is low or there is an excess of moisture they appear to assume a resting stage in which they are very feeble, and it is in all probability in this stage that they hibernate. The pupa stage lasts from 11 to 16 days, so that the total duration of the three stages works out at about 3 months. This corresponds with the incidence of flies in nature. They appear and increase rapidly in numbers from the end of May and throughout June, these individuals being probably from last year's larvae; they diminish during July and the beginning of August, and again become numerous from the latter half of August until November, when they disappear.

Habits of the Flies.—On warm still sirocco nights from June to October flies are to be found. They appear at sunset, and if the wind has kept them in their breeding haunts for a day or more their biting is very noticeable. When the wind blows at night they do not appear until it drops and disappear at daybreak, and if a wall be then watched they may be seen entering it. Wind seems to be very objectionable to them, for, even in a cage, if exposed to a breeze they cling to the chiffon covering and their wings become twisted. They do not like daylight and direct sunlight appears to be injurious to them. They are attracted by artificial light, if not too bright; thus they will not fly to electric light, but it has been noticed that if a piece of white paper be put beneath the oil lamps used in barracks it is soon covered with the bodies of the flies which have been burnt during the course of the evening.

Distance of Flight.—This is a very difficult question to settle, but certain observations have been made which throw some light upon it. Fort Chambray has its barrack block placed on a plateau well exposed to the wind and 40 to 50 yards from the nearest fortification walls. Here the men do not suffer from the bites of sand-flies. The married quarters, which are close to the bastion wall, at a distance of 15 to 20 yards, were infested with flies. It would thus appear that the range of flight is something less than that of the mosquito; the height of flight cannot be accurately determined, but there is no doubt that, except where the building is on a bastion or where there are rubble walls erected against the building, the upper floors are much freer from the fly than the lower.

Food.—Both male and female flies have a habit of burying their mouth-parts in moist organic detritus. The females alone are blood-suckers and no male fly has been found to contain blood. The females will suck blood from any warm-blooded animal, and have been caught issuing from a wall with fresh blood in the stomach, probably from biting a rat.

Prophylactic Measures.—It was suggested in 1910, that if all walls in close proximity to barrack rooms were properly faced so as to prevent communication with the interior, the number of flies would be lessened. This was done on an experimental scale in the Floriana Barracks which have always been notorious for cases of sand-fly fever. About 60 yards of the wall was cleared of vegetation and all cracks and holes were filled in, and, apparently as a result, in the early part of the season the barracks were remarkably free from sand-flies, though later they made their appearance. It seems to be necessary, in order to keep down the flies, to maintain a constant supervision of these walls, as holes made by ants and wood lice were found to harbour them.

The author details a number of precautions to be taken in these barracks, which practically resolve themselves into the facing of walls, the removal of heaps of stones and the blocking of all holes which might serve as shelter places for the flies; also, covering the ventilators with fine-meshed wire gauze, and the cleaning of all rough, made ground from weeds, so that all holes may be discovered and filled up with beaten earth. The encouragement of gardening on such grounds is, he thinks, also desirable. Large embankments should be planted with native aromatic plants such as thyme, pennyroyal, &c., and kept well earthed.

Within the barracks themselves, he advises free ventilation, and the keeping of bed-cots away from the walls; kits, great coats, and black kit bags should be taken down and removed from the walls daily, as these are a harbour of refuge for the fly during daylight; and lastly ointment should be provided for the use of the men, 1 oz. of which, if used as directed, will easily last a man through the summer.

Vegetation *per se* does not appear to have any connection with the breeding places of the sand-fly, but trees against a house attract them, owing to the protection against the wind afforded by them.

Austen (E. E.). **A New Species of *Hippobosca* from Northern Rhodesia.**—*Bull. Entom. Research*, iii, pt. 4, Dec. 1912, p. 417.

This is an extremely small species found at Nawalia, North Eastern Rhodesia, 21. ix. 1911, on haartebeeste (*Alcephalus lichtensteini*, Peters).

Scordo (Dr. F.). **Sulla questione della transmissibilitá del Kala-Azar per mezzo di alcuni insetti ematofagi.** [On the possible transmission of kala-azar by certain blood-sucking insects.]—*Malaria e Malattie dei Paesi Caldi*, iv, pt. 1, Jan. 1913, pp. 20-32.

The author, after reviewing the cases of transmission of *Leishmania* reported by various authors and detailing a number of experiments by himself as to the capacity of mosquitos for taking up *Leishmania*, points out certain difficulties as to the acceptance of many of the results obtained as a basis for a generalisation. He emphasises the fact that in those countries in which the percentage of infected dogs is possibly large, and in which neither fleas, bugs nor mosquitos are in any sense deficient, children affected with kala-azar are often not to be found, despite their constant and intimate association with dogs; and it appears to him remarkable that in those countries where kala-azar is endemic the number of cases is relatively small. Sergent has recently discovered that in Algeria there are cats apparently spontaneously infected with *Leishmania*. He finds a difficulty in understanding how with the wide distribution of *Leishmania* and such a large number of possible vehicles for its transmission, cases of kala-azar are relatively so few and that, at all events within his own observation, what may be called family epidemics, which ought to take place in these circumstances, are wanting. If all the insects in whose body *Leishmania*, or forms at present undistinguishable from Leishmania, have been discovered, are capable of transmitting the malady to human beings, why are there not more cases?

In his opinion the epidemiology of kala-azar does not correspond with the view that one of the common blood-sucking insects is the vehicle, but rather that the disease is due to the bite of some insect which, in all probability, is by no means so common as those which have been incriminated, and that its bite is rather accidental than habitual. Thus, whilst not denying the possibility that one of the common blood-sucking insects, possibly a *Cimex* or a *Pulex*, may be a carrier, for the reasons above given, he is not satisfied that these insects are the ordinary carriers.

A bibliography of the subject concludes the article.

Spencer (H. A.). **Chigger Flea or "Chigoe" in the Transvaal.**—*Transvaal Medical Journal*, viii. no. 5, Dec. 1912, p. 833.

This pest has lately appeared in the local gaol at Middelburg. It has been already reported in the Transvaal and appears to be spreading. The cases were entirely confined to native prisoners.

Forty years ago this flea was introduced into Ambriz, south of the Congo, by a ship from Brazil, and spread with incredible rapidity. It was supposed to have been taken to the region of the Great Lakes by Stanley's expedition, and during the last 25 years it has spread south and east, so that in many parts of tropical Africa it is more common than in South America or the West Indies. It does not appear to have spread elsewhere in temperate climates, but is at present endemic in Zanzibar, Mauritius and in other parts of the east coast of Africa.

There is now no doubt that this pest has obtained a footing in South Africa, and will be found in many at present unsuspected places, such as gaols, compounds of mines, etc., in fact, wherever the East Coast boy goes. In addition to being spread by the feet of these natives, the flea will affect any warm-blooded animal, especially rats and fowls, whilst in every country where they occur they are believed to be carried about by pigs, and the styes of these animals harbour great numbers. The parasite has been credited with the conveyance of "yaws," but this is probably unfounded.

Noel (P.). **La Guerre aux Mouches.** [Destruction of Flies.]—*Bull. du Laboratoire Régional d'Entomologie agricole, Rouen*, 1913, pp. 4 & 5.

In the course of this article, which is chiefly a summary of work done in the United States and England, the author cites the following experience, as possibly pointing to a method by which flies may be destroyed, at all events in certain places.

At Nid de Verdier, near Fécamp, in Seine-Infèrieure, there is a fish-culture establishment and the Director, having found by experience that the best food for the young fish was living fly maggots, and being in need of a regular supply, deposited pieces of waste meat in various parts of the establishment with the object of attracting the flies and obtaining the required maggots easily. In this he was successful, but having carried on the method for a comparatively short time he found that it no longer supplied him with food for his young fish, the reason being apparently that there was not a sufficiency of flies left in the neighbourhood. The author thinks that this simple plan, if widely adopted, might prove of great service in diminishing the number of flies, that is to say, by providing definite meat traps, instead of allowing the flies to deposit their eggs in household refuse and the like.

Schwetz (J.). **Les Glossines et la Maladie du Sommeil dans la Vallée de la Lukuga.** [Tsetse-flies and Sleeping Sickness in the Valley of the Lukuga.]—*Archiv für Schiffs- und Tropen-Hygiene*, xvii, no. 2, 1913, pp. 37-54, 2 figs.

With the exception of one single river, the Lugumba, all the western affluents of Lake Tanganyika come from the mountains, that is to say, lose their *G. palpalis* quite close to the lake, and they are therefore not of much consequence in the dissemination of sleeping sickness; this is not the case with the Lukuga. Between the western shore of Tanganyika where the disease exists and the Lualaba and Luvua Rivers, where the disease also exists, there is an intermediate very mountainous district free from human trypanosomiasis. This region is free because it is mountainous and *G. palpalis* is not found there. A very few sufferers from the disease are to be seen in this area, but they are not dangerous to their neighbours, provided that they do not go down to the river or lake. Communication between Albertville and Kiambi merely crosses the Lukuga valley so that caravans going that way are not long exposed to the risk of infection.

The author describes the river as containing plenty of water, and the vegetation on the banks as luxuriant and offering plenty of shade. *G. palpalis* and *G. morsitans* are found throughout the whole length of the valley, *palpalis* close to the river and its banks, whilst *morsitans* occupies the rest of the valley and the shores of Tanganyika. *G. palpalis* is far from being constant. There are places where for a distance of 10 or more kilometres not a single specimen is to be found; for example, between Albertville and the Lukuga *palpalis* is not met with until the mouth of the river Lugumba is reached. On the Lukuga itself, however, there is not a yard free from the fly, and the author says that when going from the lake as far as Mlange they did not give him a moment's rest. The caravan route already mentioned as crossing the river swarms with the fly, but at a comparatively short distance from the river *palpalis* disappears, its place being taken by *morsitans*, and it appears to be a fact that along the whole valley of the Lukuga the two species do not live together.

G. morsitans is not uniformly distributed over the whole valley. It is very numerous on the level areas, but much scarcer on very broken ground: at Kiluba and Milliminua the fly is not only found near the villages, but actually within them.

The author had no opportunity of examining microscopically any of the flies for the purpose of determining the proportion infected, but the fact that he lost both of his dogs, and that an official from Albertville who travelled with a donkey along the valley of the Lukuga lost the animal a month after his return to Albertville, is sufficient proof that the flies in this valley carry the disease. *G. fusca* was captured near Kanhogo, which is on the river bank, and a little later the author, with the assistance of his men, captured a large number of flies and found that they were a mixture of *fusca* and *morsitans* in the ratio of about 1 to 3. As he approached the village of Mikato *G. fusca* gradually became scarcer, disappearing entirely a little before he reached the place. There is nothing in the character of this part of the valley to distinguish it from the rest, but nowhere else along the Lukuga did the author see *G. fusca*.

The population of the Lukuga valley appears to be small and collected in very small hamlets. The author says that there is no doubt that in most of the villages sleeping sickness for the moment does not exist, but that in some of them there were isolated cases. He regards the information given him by the natives as to the previous existence of the disease as so utterly untrustworthy that nothing can be based upon it, but he was able to obtain a certain amount of evidence that about five years ago the disease was present in the upper part of the valley and that it died out. Any attempt to clear away the vegetation on the banks of the river is out of the question. The number of inhabitants is so exceedingly small that the best prophylactic measure will be to remove them to some safer place. The railway which is to cross the Lukuga valley in the near future presents a difficulty, in that the persons employed on its construction or in its working may bring about a recrudescence of the disease.

NICHOT (—). **A propos de la fièvre à Pappataci.** [On Pappataci Fever.]—*Bull. Soc. de Path. Exot.*, v, no. 10, Dec. 1912, pp. 780 & 781.

Leger and Séguinaud have confirmed the relation between *Phlebotomus* and pappataci fever in Corsica. The author has recorded the frequent occurrence of the insect around Oran, in Algeria. Sergent has discovered them at Biskra and makes a somewhat comprehensive assertion that they are to be found all over Northern Africa. The author has collected specimens from Djenan-ed-Dar and the district of Djenan Ounif, which is seriously infested. There can be no doubt that there are within the area a large number of centres.

In France, besides the district of Montpellier and the Alpes-Maritimes from which it has been recorded, Rouyer considers that it occurs also in the departments of the Basses- and Hautes-Alpes and even in the Isère, Mont Genèvre, the district of Briançon and the Valley of l'Osians. In the near future this list will probably be increased considerably. Rouyer also suggests that its distribution is probably being extended by the movement of sheep to and fro from the mountains.

Marchoux (E.) & Couvy (L.). **Argas et Spirochètes.**—*Bull. Soc. Path. Exot.*, v, no. 10, Dec. 1912, pp. 796-798.

Dutton and Todd were the first to discover in the organs of *Ornithodorus moubata* the presence of small rounded bodies with a central point, which they supposed might be stages in the evolution of *Spirochaeta duttoni.* Later Leishman described under the name of "granules" certain small coloured bodies which were found in abundance in all the tissues of *O. moubata* and in all phases of its development, even in the egg, and he considered that these were ultimately transformed into *Spirocheta.* Balfour found these granules in *Argas persicus* and showed that they were derived from the segmentation of spirilla in the digestive tube. This has been confirmed by Fantham and Hindle, but spirilla were not found in the Acarid except for a few days immediately following the infected meal, and the inoculation of the tissues of these ticks, containing no spirilla but crowded with granules, has caused spirillosis in susceptible animals; so that one must assume that these granules are capable of carrying infection. The authors have already shown that spirilla are constantly present in the general body cavity of *Argas persicus* kept at a temperature of 27° C., and they have found them 45 days after a meal in 90 per cent. of the ticks and also in certain individuals kept in the laboratory at 15° C. without food for 11 months.

The authors suggest that as the spirilla are exceedingly minute, they may have been injected with the granules in the experiments cited. They have themselves experimented with *Argas vespertilionis* from Timbuctu. Six specimens were found to contain granules identical with those of Leishman. They were caused to bite bats, their exclusive hosts, and the results were negative. They also examined specimens of *Rhipicephalus ricinus* taken in the west of France from a healthy dog. Ten of these contained large quantities of Leishman granules, which elongated when kept at a temperature of 37° C. for 3 days. They found them also in numerous specimens of *Laelaps echidninus.* It would thus appear that these Leishman granules are to be found in all Acarids and that they have no connection with *Spirocheta.*

Stanton (A. T.). **On the changes which occur in certain characters of *Anopheles* larvae in the course of their growth.**—*Bull. Entom. Research*, iii, pt. 4, Dec. 1912, pp. 387-391, 6 figs.

It is generally admitted that the ability to determine species of *Anopheles* by an examination of their larvae would place a valuable weapon in the hands of the practical sanitarian in tropical countries. Very often the adult *Anopheles* is difficult to find and if the larvae are transported to a distance they frequently do not develop, and thus very desirable information is lost. By breeding out larvae of *Anopheles* from the eggs of known species in the Malay Peninsula it was possible to follow their various changes up to maturity. The following species were those studied:—*A. albirostris,* Theo., *A. sinensis,* Wied., *A. fuliginosus,* Giles, *A. karwari,* James (= *nigrans,* Stanton), *A. umbrosus,* Theo., *A. rossi,* Giles, and *A. ludlowi,* Theo. The author has selected *A. albirostris,* Theo., one of the malaria-carrying species of the Malay Peninsula, for description.

Save in the case of a few closely-related species, of which *rossi* and *ludlowi, sinensis* and *barbirostris* are examples, the mature forms of larvae of Malayan *Anopheles* have been found to possess characteristic features which permit of their specific differentiation. So far, only the anterior and posterior clypeal and the palmate hairs have been studied in detail, and it is hoped that further study will reveal points of difference which will render possible the recognition of the mature forms of *all* valid species. It may well be that the distinctive characters which may be observed in these developmental stages will form the basis for a more satisfactory grouping of adult *Anopheles* than that which has been founded upon scale characters alone.

NEWSTEAD (R.). **Notes on *Phlebotomus,* with descriptions of New Species—Part I.**—*Bull. Entom. Research,* iii, pt. 4, Dec. 1912, pp. 361-367, 3 figs.

The species recorded are:—

P. minutus, Rond.—Malta and Suda Island.

P. minutus, var. *africanus,* var. nov.—Gold Coast: Salaga; Southern Nigeria: Onitsha; Northern Nigeria: Baro; Anglo-Egyptian Sudan: Tokar, Red Sea Province; North Eastern Rhodesia: Luangwa Valley; Nyasaland: Chitala stream, 10 miles west of Domira Bay, near Lake Malombe, Upper Shire River.

P. antennatus, sp. nov.—Gold Coast: Salaga.

P. squamipleuris, sp. nov.—Anglo-Egyptian Sudan: Khartoum.

P. papatasii, Scop.—Anglo-Egyptian Sudan; Tokar, Red Sea Province.

P. duboscqi, N.-L.—French Sudan: Hombori.

NEWSTEAD (R.). **On the characteristics of the newly discovered Tsetse-Fly, *Glossina austeni,* Newstead; with descriptions of the Genital Armature of *Glossina fuscipleuris,* Austen, and *Glossina longpennis,* Corti.**—*Bull. Entom. Research,* iii, pt. 4, Dec. 1912, pp. 355-360, 3 figs.

The title of this paper sufficiently explains its contents, which are strictly descriptive and morphological.

Edwards (F. W.). **Revised Keys to the known Larvae of African Culicinae.**—*Bull. Entom. Research,* iii, pt. 4, Dec. 1912, pp. 373-385, 9 figs.

This paper contains a revision and amplification of Wesché's work on African mosquito larvae (Bull. Ent. Res. i, April 1910, pp. 169-230, pls. i-vii), and is based largely on material obtained by Dr. A. Ingram in the Gold Coast. Keys or descriptions are given of 12 species of Anopheline larvae and of 34 Culicines belonging to 12 genera.

Austen (E. E.). **New African Tabanidae—Part III.**—*Bull. Entom. Research,* iii, pt. 4, Dec. 1912, pp. 399-416, 4 figs.

The following list shows at a glance the countries in which these additions to our knowledge of the blood-sucking flies of Africa have been obtained.

Diatomineura	*lineatithorax,* sp. n.	Northern Rhodesia.
,,	*penetrabilis,* sp. n. ...	,, ,,
,,	*hastata,* sp. n. ...	Portuguese East Africa.
Haematopota	*grahami,* sp. n. ...	Ashanti: Sierra Leone Protectorate.
,,	*dareyi,* sp. n. ...	Nyasaland Protectorate.
,,	*rubens,* sp. n. ...	Nyasaland Protectorate; Northern Rhodesia; Southern Rhodesia.
,,	*beringeri,* sp. n. ...	Gold Coast (Northern Territories); Northern Nigeria.
,,	*crudelis,* sp. n. ...	German East Africa.

Noc (F.). **Remarques et observations sur le rôle des Moustiques dans la propagation de la Lèpre.** [Remarks and observations on the *rôle* of Mosquitos in the spread of Leprosy.]—*Bull. Soc. Path. Exot.* v, no. 10, Dec. 1912, pp. 787-789.

The author has for a considerable period made observations upon the *rôle* of the mosquito as a possible carrier of leprosy in New Caledonia, and cites a number of observers who regard this supposition as at least very improbable. He wishes however to place on record the results of certain observations made some years ago to the effect that the bacillus of Hansen may be found in the alimentary tract of certain species of *Culex* in New Caledonia, and remarks that no matter how small the number of these bacilli so found, it is at least possible that leprosy may be transmitted by the continual repetition of the bites of these insects. He records observations which tend to show that if leprous patients were bitten by species of *Culex* which had been allowed previously to feed upon other leprous patients, the temperature of these cases rose. Further, he found in the blood of *Culex,* collected in rooms which were inhabited by persons suffering from leprosy, the characteristic bacillus of Hansen and he thinks that there is a good deal of evidence for the possibility that certain night-biting species of mosquitos, and particularly *Stegomyia fasciata* and *Culex fatigans*, may under such conditions and by a succession of bites, repeated night after night, constitute a danger. He is himself convinced that the general health of the lepers is greatly improved when they are carefully protected from mosquito bites.

Lebœuf (A.). **Dissémination du bacille de Hansen par la mouche domestique.** [Dissemination of the bacillus of Hansen by the house-fly.]—*Bull. Soc. Path. Exot.*, v, no. 10, 1912, pp. 860-868.

The author, after citing the principal writers on the subject, mentions the experiments of D. H. Currie in Hawaii with *Musca domestica, Sarcophaga pallinervis, Sarcophaga barbata, Volucella obesa* and an undetermined species of *Lucilia*, and also those of T. L. Sandes. In the author's experiments the flies were allowed to settle upon an ulcer and after they had rested there a certain time they were examined, and as a result he found that a large proportion of the flies contained Hansen's bacillus in their intestines. He obtained in all 19 positive results. The question as to how far from a possible source of infection flies may be found carrying the bacillus, was investigated by the author who dissected 23 flies collected in his own house, which was distant 150 metres from a hospital reserved for very advanced cases of leprosy. In none of them did he discover the bacillus, and he arrives at the following general conclusions:—

(1) *Musca domestica* is capable of absorbing enormous quantities of Hansen's bacillus; (2) the bacillus is found in large quantities, apparently in perfect condition, in the excrement of infected flies; (3) there does not appear to be any multiplication of the bacillus within the fly, but the microbe does not seem to degenerate; (4) it is possible that flies passing from a leprous patient and depositing their excrement upon raw cutaneous surfaces of otherwise healthy persons, living in the immediate neighbourhood of leper patients, may disseminate the bacilli in this way.

Rodhain (J.), Pons (C.), Vandenbraden (J.), & Bequaert (J.). **Note sur les trypanoses animales de Haut-Katanga.** [Notes on animal trypanosomiasis in Upper Katanga.]—*Bull. Soc. Path. Exot.*, v, no. 10, 1912, pp. 819-822.

One of the authors whilst residing in Elizabethville, Belgian Congo, took the opportunity of examining a large number of animals from Rhodesia to be used as food or as draught animals. Since the foundation of the new capital, *G. morsitans*, which was formerly very numerous on the site of the present town, has disappeared in consequence of the clearings which have been made, but when the boundaries of the cleared areas are approached the flies are still found in large numbers. It is therefore not surprising that animals brought up from the south should be rapidly infected the moment they are located in areas outside the town. Out of 291 animals examined 40·3 per cent. of mules and 25·9 per cent. of donkeys were found to be infected with *T. brucei;* 20 per cent. of the oxen with *T. congolense*, and 70 per cent. with *T. cazalboui;* 53·6 per cent. of the pigs were infected with *T. congolense*; 1·7 per cent. of the goats with *T. congolense* and 1·8 per cent. of the sheep with *T. cazalboui.* Of 7 pigs examined, 5 were infected with *T. brucei* and 2 with *T. congolense.* Two of the oxen and one goat were infected at the same time with *T. congolense* and *T. cazalboui*, and one dog was infected with both *T. congolense* and *T. brucei.* These figures seem to show that cattle and similar beasts are able to resist infection by *T. brucei (brucei pecaudi)*, which is unfortunately very virulent in Elizabethville. It is interesting to note that on the high plateau to the south of Katanga, where *G. morsitans* alone exists, this fly is able to transmit the three same types of trypanosomiasis as those which it spreads in the lower regions to the north of the province.

Leger (Andrè). **Un petit centre d'endémicité de maladie du sommeil à Kaulikoro, près Bamako, coïncidant avec des gîtes permanents à** *Glossina palpalis.* [A small endemic centre of sleeping sickness at Kaulikoro, near Bamako, coinciding with a belt of *Glossina palpalis.*]—*Bull. Soc. Path. Exot.*, v, no. 10, 1912, pp. 828-832.

Human trypanosomiasis has been reported as endemic at various points in the French Colony of Upper Senegal and Niger, and especially towards the south and at the centre of a loop described by the river in the district of Koury, where the malady has been so intense that it has been found necessary to remove the station.

The author had the opportunity of examining two natives brought up at the Agricultural Station of Kaulikoro suffering from the disease and discovered in addition that in the village itself there were a number of cases of sleeping sickness which had not been reported. The distribution of the disease coincides with belts of *G. palpalis.* At first an inspection of the area occupied by the agricultural station and its immediate neighbourhood did not reveal any *Glossina* nor any place suitable for their reproduction, but after some further investigation a small stream about 200 metres from the station and more or less dried up in the dry season and surrounded by brushwood was found to be infested by them. Further small areas within a radius of 3 or 4 kilometres were also found to be infested with the fly, and these were particularly dangerous because they lay in the track of persons going to and from the station. The whole length of this stream was found to be swarming with *Glossina* at almost all seasons of the year. The Director of the station, whose house was only 200 metres from the stream, showed the author a number of *Glossina* which he had taken in his bedroom. It would appear that human trypanosomiasis has always existed in this part of the Sudan, and the only reason why at the present moment the disease has not made very great progress, lies in the fact that the areas frequented by the fly are not numerous or of any large extent in the neighbourhood of inhabited centres, but they nevertheless exist. There is some evidence that the natives of these parts have been obliged frequently to change the site of their villages for reasons clearly connected with the disease. The authorities have given the necessary instructions for the clearing of the bush in all places known to harbour the flies, and it is hoped that these measures will lead to the stamping out of the disease.

Bouget (G.) & Roubaud (E.). **La piroplasmose (nuttalliose) de l'âne en Afrique occidentale.** [Piroplasmosis (nuttalliosis) of the ass in West Africa.]—*Bull. Soc. Path. Exot.*, v, no. 10, 1912, pp. 806-808.

There are two piroplasmoses of the Equidae at the Cape, one being due to a parasite for which França has created the genus *Nuttallia*, and the other caused by a true piroplasm (*Piroplasma caballi*, Nuttall).

Theiler has shown that the disease is transmitted by a tick, *Rhipicephalus evertsi*. It is common in South Africa and the infection amongst imported horses is almost always acute and often fatal. The native animals on the contrary suffer from a more or less chronic disease which generally ends in immunity, but if the blood of the immune horses be transferred to a healthy horse the latter will acquire the disease. There is some difference in the character of the disease in the horse, the ass and the mule respectively. The author reports observations upon donkeys made in Senegal and considers that he has abundant satisfactory evidence of the existence of the disease caused by *Nuttallia equi* in Western Africa.

Franchini (G.). **Leishmania et punaises.** [Leishmania and Bugs.]—*Bull. Soc. Path. Exot.*, v, no. 10, 1912, pp. 817-819.

The author examined 300 bugs from Sicily and Northern Italy. These were starved from 8 to 12 days and then allowed to bite a case of kala-azar. He was able to find only a few *Leishmania* in six of them. The bugs were killed at various times from half an hour up to 22 days after biting the patient. The author thinks that the few parasites which survived for a short time did so chiefly because of the presence of culture liquid which had been sucked up by the bug and not to favourable conditions existing in the insect, and he is decidedly of opinion that the intestine of the bug is not a suitable place for the propagation of *Leishmania infantum*. He has also examined large numbers of bugs taken from the beds of patients affected with kala-azar in Sicily, and has never been able to find parasites which he could identify with those of leishmaniasis.

Britton (W. E.). **Mosquito Plague of the Connecticut Coast Region, and how to control it.**—Report of the Connecticut Agric. Expt. Sta. in Newhaven, Connecticut, 1912, pp. 259-283.

The salt marshes along the coast furnish the principal supply of mosquitos in the southern portion of the State, for the species which breed in these marshes fly inland for long distances. They are large and very abundant, biting to such an extent that they make life a burden to many inhabitants, and keep away summer visitors from the Connecticut coast. The two species which breed abundantly on the salt marshes are *Culex cantator*, Coq., and *Culex sollicitans*, Walk. The former breeds early in the season, but about 1st July is almost or wholly replaced by the latter. The area of these marshes is 22,264 acres, or about 34¾ square miles, distributed evenly along the coast in the southern parts of the State. The mosquito surveyor of Connecticut reported in 1904 that half of the entire salt marsh area of the place had at some time been thoroughly drained for hay farming. Other portions are well drained naturally and produce few mosquitos. It is the neglected marshes which are the cause of the trouble and in the author's opinion they are in a worse condition to-day than they were 30 or 40 years ago. They are so clogged with vegetable matter that the fresh water received from the land cannot pass through them and consequently stagnates. It has been estimated that the total cost of draining these marshes would not be more than about £36,000.

One of the results of draining salt marshes is that the character of the vegetation changes and the spike grass (*Distichlis maritima*), which is characteristic of mosquito-breeding areas and which yields only a small quantity of very inferior hay, gives place to black grass (*Juncus gerardi*), which makes good salt hay and yields well. Areas which have been drained have been known to produce 20 times as much hay as before the operation. Oiling the marsh has been successfully tried in places where the vegetation is not too thick, and a cheap sprayer consisting of a cylinder of galvanised iron holding about 2½ gallons of liquid, containing a pressure pump, and costing about 4½ dollars, is found to be an efficient apparatus for the purpose.

The remainder of the report is occupied with details of work done, either by public authorities or at the instigation of private individuals. By means of lectures, newspaper articles and circulars the population of the area has been awakened to the fact that a great deal can be done to remove the pest at a very moderate expense, but at the same time these sporadic efforts have not the value of a combined scheme for dealing with the whole area. In certain parts of the district the species breeding in stagnant fresh water cause considerable trouble.

Galli-Valerio (B.) & Rochaz de Jongh (J.). **Beobachtungen über Culiciden.** [Observations on Culicidae.]—*Centralblt. Bakt. Parasit. & Infect. Krank.*, lxvii., heft 6, Jan. 1913, pp. 472-478, 3 figs.

The hibernation of Culicidae.—Larvae were observed to emerge from the eggs of *Ochlerotatus* (*Culex*) *nemorosus*, Mg., and *Anopheles bifurcatus*, L., from 15th-30th Oct., and numbers of *Culex* larvae were found on 26th Nov. in excavations in the soil filled with leaves and containing water. In the winter of 1911-12 these were so numerous that as many as 25 were taken from a single small puddle. The *Culex* larvae did not begin to grow till January and the *Anopheles* not till March. The first larvae of *O. nemorosus* and *Mochlonyx* (*Corethra*) *velutinus* which had wintered in dead leaves were taken on 13th Jan. Large quantities of larvae of *A. bifurcatus* were taken in puddles near Sondrio, Northern Italy, on 23rd March, producing chiefly males in the laboratory. Larvae of *Anopheles maculipennis*, Mg., were first taken near Sondrio in quantity on 23rd July. The imagos of *C. pipiens*, L., wintered in 1912 in the cellars in Orbe, but were not so numerous as in the winter of 1910-11.

Notes on breeding places.—In some puddles great quantities of eggs of *C. pipiens* were found on 28th March, generally laid on decaying leaves; as many as 350 egg-rafts were found in one pool barely a yard across and 30 more were taken from the same pool the next day. These eggs produced larvae in the laboratory on 29th and 30th March, pupae on 25th May, and 3 or 4 days later imagos of *C. pipiens*. Larvae of *Ochlerotatus* (*Culicada*) *ornatus*, Mg., were found in the stem of a horse chestnut (*Aesculus hippocastanum*) on 22nd July and at the foot of a white fir (*Abies pectinata*) in a hole full of moss and containing little water. On 21st April a quantity of *Culex* larvae were found in an enamelled iron pot which had been thrown away. On a pasture 3,400 feet above the sea a pool caused by water from the roof of a hut and prevented from running away by a manure heap, contained many thousand larvae and pupae; at 5,000 feet a pool of a similar character contained innumerable larvae of *O. nemorosus*, and in another pool at 6,000 feet large numbers were again found, while at various heights even the hoof-marks of cattle contained larvae.

The authors for the second time report the finding of great quantities of larvae of *C. pipiens* and a few of *A. maculipennis* in a tub which had contained bouillie-bordelaise; all were dead. *Lemna palustris* when growing freely and covering the surface of the water in ditches, etc., appears to interfere with the life of Culicid larvae and pupae.

The biting of mosquitos.—The authors observed that *C. pipiens* and *A. bifurcatus* bit in houses on 2nd May, *O. nemorosus* in the woods on 12th May, and in 1912 in the mountains, at a height of nearly 6,000 feet; in bright sunlight on 18th Aug. it was very troublesome. One of the authors was bitten in a railway carriage on the evening of 22nd June 1912 by a male of *Theobaldia annulata*, Schr.; the bite was painful.

Methods of destruction.—The authors have experimented with sunflower oil and found that if sprayed on to the surface of water it had a tendency to form minute globules instead of an even layer; the use of a cloth dipped in the oil and dragged over the surface is the best and most economical method. An even layer of oil destroys the larvae and pupae in 3-4 hours, but if globules are formed they will live for as many days.

The paper concludes with detailed descriptions of the eggs of *Ochlerotatus ornatus*, Mg., and of *Anopheles nigripes*, Staeger, and some notes on their development.

KINGHORN (A.) & YORKE (W.). **Further observations on the Trypanosomes of Game and Domestic Stock in North Eastern Rhodesia.**—*Ann. Trop. Med. & Parasitol., Liverpool,* vi, no. 4, Dec. 1912, pp. 485-487.

The authors record in detail the results of the examination of a total of 127 head of game, comprising 19 genera, at Nawalia, trypanosomes having been found in 33 by direct examination, by inoculation, or by both methods. At Ngoa, 124 head were examined and 21 were found to be infected. The authors place the percentage of game infected near Nawalia at 50, and near Ngoa at 35. No data exist as to the ultimate effect of infection on game; all the animals shot appeared to be in perfect condition and presented no objective signs of disease. Certain differences in the percentage of infection were observed in various species of game, which the authors think may possibly be explained by their habits.

Kudu, bushbuck and waterbuck are usually found in thick cover, from which they seldom emerge and in which they are more constantly exposed to the bites of tsetse-flies. Mpala, puku and wildebeest are found in open country, spending the greater part of the day on the wide bare plains where the fly is much less numerous than in the bush; but the authors are of opinion that specific differences in the immunity enjoyed by buck are probably of greater importance. At a village 40 miles south-west of Nawalia only two head of cattle were found to be left out of a large herd which existed there some four or five years ago; one of these was in good condition, the other sick. At the end of August 1911 and again at the beginning of April 1912, numbers of goats were to be found in several of the villages on the main road from Nawalia to Fort Jameson, but by the end of April 1912 not a single animal was alive; *G. morsitans* was found around all these villages. It has been suggested that small vermin might also act as reservoirs of trypanosomiasis, but of 164 such animals examined none were found infected. The authors are of opinion that the nocturnal habits of these creatures affords the explanation, in that they are not bitten by the fly. No less than 256 monkeys were also examined, without result, and it appears to the authors probable that the monkeys catch the tsetses before they have time to bite, though they are frequently bitten by mosquitos when they are asleep at night.

Yorke (W.). **Sleeping Sickness and Big Game.**—*Month. Mag. Chamb. Commerce, Liverpool,* xii, no. 1, Jan. 1913, pp. 4-9.

In this address the author reviews the general history of sleeping sickness and the discovery that it can be transferred from man to man by *Glossina palpalis.* In 1908 the disease was unknown in Nyasaland, but in 1909 and 1910 a number of cases occurred amongst Europeans and natives. The disease has also been found in Rhodesia. The investigations carried out by the author, Dr. A. Kinghorn and Mr. L. Lloyd were made around Nawalia, N.E. Rhodesia, the site of an old Government station in the Luangwa Valley, about 400 miles from the railway. Pack-animals could not be used for the journey because, owing to the presence of the tsetse-fly (*G. morsitans*), they quickly succumb to trypanosomiasis; but antelopes of various kinds were present in the valley in enormous numbers. The author remarks incidentally that the old idea of suitable dress for travelling or hunting in tropical Africa needs modification. In order to avoid the attack of the tsetse-fly it is essential that as little skin as possible should be exposed, and he recommends that a fly-switch made from a zebra's tail should always be carried and used. Khaki though an excellent colour from the hunter's point of view, appears to attract tsetses in large numbers. The natives are more liable to be bitten than Europeans owing to their wearing practically no clothes.

In this district *G. palpalis* does not exist, but *G. morsitans* is present in enormous numbers, and the investigators have been able to prove that this fly is responsible for the spread of sleeping sickness in man. Unlike *G. palpalis,* it is not limited to the neighbourhood of rivers or lake shores, but is found all over the country in enormous stretches, its distribution being quite independent of water. This fact renders the removal of the population from fly-centres impossible and greatly increases the difficulty of combating the disease. Another fact of great practical importance was discovered, viz., that unless the atmospheric temperature was fairly high the tsetse-fly does not become infective after biting an infected animal. This was proved by direct experiment in the intensely hot country of the Luangwa Valley, where the investigators were able to transmit the poison to healthy monkeys by means of flies which had been allowed to bite sleeping sickness patients two or three weeks before. When the experiments were repeated on the comparatively cold plateau of the Congo-Zambesi watershed, the results were negative. Unfortunately at certain periods of the year the temperature of localities over 4,500 feet above the sea is quite high enough to allow of the complete development of the parasite in *G. morsitans* and apparently they remain infected for a very considerable period.

The investigators satisfied themselves that the main reservoir of trypanosomes of man or domestic stock was the big game of the country. Removal of the population being impossible (and indeed useless under the conditions) and there being no hope whatever, in the present state of our knowledge, of getting rid of the fly, while the mere isolation of infected persons is equally futile considering the enormous reservoir of trypanosomes existing in the big game, the question arises as to whether the big game should not be destroyed. Not only is it the proved reservoir of infection, but also it has been observed that since the rinderpest swept through South Africa, 16 or 17 years ago, big game has increased enormously in numbers, with the result that there has been a corresponding increase of tsetse-fly. The destruction of the whole of the big game over a very large area of country, such as these parts of Northern Rhodesia and Nyasaland, is perhaps hardly feasible, and from other points of view not desirable, and the author advocates the advisability of attempting merely to drive back the big game from the neighbourhood of human habitations. He advises that an exact census of the population should be made and the proportion suffering from sleeping sickness determined; the same to be done in the case of domestic animals, if such exist, and the percentage of infective tsetse-flies to be ascertained. The game must be completely removed from the area and not allowed to return. After an interval of a couple of years or so, the population of domestic stock and tsetse-fly must again be carefully examined, and we should then be in a position to decide definitely whether or not the driving of the game back from the site of human habitations would pay. Such an experiment would take some years to accomplish. The investigators regard it as a matter of urgency that something of the kind should be done on a large scale throughout tropical Africa.

WEISS (A.). **Addition au Catalogue des Arthropodes piqueurs de Djerba.** [Addition to the catalogue of the biting Arthropods of Djerba.]—*Archives de l'Institut Pasteur de Tunis,* 1912, pt. 4, p. 226.

Diptera.

Anopheles algeriensis, Theo.; the carrier of *Filaria bancrofti* in man, and *Filaria immitis* in dogs.

Culex fatigans, Wied.; a carrier of the malaria of birds.

Siphonaptera.

Ctenopsylla musculi, Dugès; found on *Mus decumanus.*

Anoplura.

Haematopinus (Polyplax) aculeatus, Neum.; found on a jerboa (*Dipus sp.*).

Ixodoidea.

Ornithodorus savignyi, Aud.

The *Ornithodorus* has already been reported from Djerba in 1911 and since that time the author has found it frequently in the fields at the foot of olive trees near which cattle rest from time to time, and often close to human habitations. It has also been found on the mainland in the neighbourhood of Ben-Gardane and on the frontier of Tripoli, in July 1912. It is well-known to the natives of Tunis under the name of "tobbiah."

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Ringenbach (J.). **Contribution á l'étude de la distribution de la maladie du sommeil en Afrique équatoriale française (Pays Bakongo, Bakongui et Loango), Mai-Juin-Juillet 1912.** [Contribution to the study of the distribution of Sleeping Sickness in French Equatorial Africa (Bakongo, Bakongi and Loango), in May, June and July 1912.]—*Bull. Soc. Path. Exot., pp.* 34-40, 1 map.

The author was charged by the Governor-General of French Equatorial Africa to make a medical report upon the whole of the region which would be traversed by the Southern Congo Railway which is intended to join Pointe Noire to Brazzaville.

In Bakongo 30 villages were visited and 1,393 individuals examined; 1·21 per cent. were found to be suffering from trypanosomiasis. The proportion of persons affected varies considerably; in the Bakongi country 1,063 were examined and 54 found to be attacked, that is 4·98 per cent.; in the Kuilu district 592 persons were examined and 21 were found to be attacked, that is 3·5 per cent. In all the districts the distribution of the disease was more or less irregular, and the author points out the danger of the infection of practically healthy villages by the inhabitants of the infected ones, owing to their both using the same streams as sources of their water-supply, for along the banks of these streams *Glossina* is by no means uncommon.

In the village of Kimanga, situated between Buende and Boko Songho on the left bank and 50 metres from the River Inda, an affluent of the Sudima, the household of the chief, consisting of 18 men, 35 women and 29 children, yielded 6 men, 7 women and 3 children attacked by the disease.

The author remarks that instances of this kind, which are by no means uncommon, and what may be described as cases of family contagion, explain the disappearance of whole villages; similar cases have been observed by other travellers. Round the village of Kimanga there is no dense bush, but mosquitos of the genera *Mansonioides* and *Anopheles* are plentiful and *Glossina palpalis* is by no means uncommon.

Throughout the whole course of their journey the authors met with *Glossina palpalis* everywhere along the river-banks, though somewhat scarce in the dry season. Among other biting insects they met with mosquitos of the genera *Anopheles*, *Myzomyia*, *Stegomyia* and *Mansonioides*; also *Ceratopogon*, and almost everywhere, especially in dirty houses, the blood-sucking larvae of *Auchmeromyia luteola*, the chigger flea (*S. penetrans*), bugs and lice.

Ouzilleau (Dr.). **Rapport sur la tournée médicale effectuée en pays Yakoma.** [Report on a Medical Tour in the Yakoma country.]—*Annales d'Hygiène et de Médecine Coloniales*, xv, no. 4, 1912, pp. 819-825.

The author and a companion made a tour of medical inspection to Yakoma and its neighbourhood, on the northern frontier of the Belgian Congo. The report is chiefly concerned with the incidence of sleeping sickness in the district, and they find that the villages of the Yakoma on the right bank of the River Ubangi are the centre of a seriously infected area.

None of these villages are more than 300 to 400 metres from the river-bank, as beyond that there is an absolutely desert region, parallel with the river, of 15 to 20 kilometres in width. This strip of country constitutes the northern frontier of the infected area. On the east the disease does not reach further than Bosekwi along the banks of the Mbornu, but commences to spread out in the district of Wango and disappears completely from a point marked by the mouth of the Mbari. The position of this infected area and its natural isolation are such that it seems possible to stamp out the disease, or at least to prevent its spreading, which is specially important because it menaces seriously the whole of the neighbouring district of Bangassu.

The author says that it is impossible to assert that the limits of the malady are coincident with those of certain insects, and it is equally impossible to say that any area which has been spared up to the present is definitely safe from the disease. Many examples show that it may break out in countries where biting flies are rare, and where *Glossina* is totally absent. In a word, it is not known how the disease is propagated, and there is always the fear, especially in countries which it has never visited, that it may break out with greater violence than in those in which it is endemic.

The author having once passed over the country and observed the conditions, decided to visit all the inhabitants of the Yakoma villages from the mouth of the Kotto as far as Basekwi, and to treat every person found suffering from the disease with an injection of one gramme of atoxyl, not so much with the idea of curing the patients, as of rendering them incapable of contaminating healthy persons, and so to limit the progress of the plague. Out of 6,264 persons examined, he found 1,037 ill with sleeping sickness; and in certain places the proportion was very much higher. In that part of the river, for example, between Kotto on the one hand and the regularly inundated and inhabited zone which exists above the village of Lazida, on the other, he found 66·8 per cent. attacked, and in another village 79 per cent. He then gives figures collected from G. Martin ("La maladie du Sommeil au Congo") which show that in certain districts where 32 cases were found in 1907, there were 701 in 1912.

Dr. Ouzilleau also quotes instances in which a village after suffering very seriously from the disease two years ago is now almost healthy, though in the midst of other villages, the population of which is being decimated by it. He remarks that in some villages the disease is localised in certain quarters and even in certain houses; for instance, at Ziamba seven out of nine cases were in the same family, the members of which either inhabited the same buildings, or buildings within the same fence, and were either the wives or brothers or children of the Chief Ziamba, who died of the disease about a month before the author's visit. Facts of this kind, in the opinion of the author, support the theory that possibly the disease may not be transmitted exclusively by insects that inhabit the bush outside, that is to say, tsetses; but that it may also be carried by domestic insects, such as, mosquitos, fleas, lice, etc., for such insects would be much more likely to produce family epidemics of the kind mentioned. He advances another interesting fact, namely, that tsetse do not exist upon the river-banks between Kangu and Wango, at least the natives told him that the fly was exceedingly rare, and Dr. Zerbini, whom the author met in the district, told him that he had never found tsetse on the Belgian bank of the river where sleeping sickness is widely spread. The author himself says that he has never seen these flies in the Yakoma district in the course of four journeys through it; but that they reappear on the Mbomu, downstream from Bangassu, from the mouth of the Mbari, and it is precisely from this point that sleeping sickness suddenly ceases.

He has seen both *G. fusca* and *G. palpalis* on the streams in the interior of the Nsakara country, also on the Mbaraye river, the Sandigi and the Mbari, where trypanosomiasis is unknown; on the other hand mosquitos abound everywhere, but especially hibernating on the banks of the Ubangi from the mouth of the Kotto as far as Lazeda.

Amongst the prophylactic measures suggested by the author is the entire reconstruction of the huts in certain Yakoma villages, the encouragement of cleanliness amongst the inhabitants, and the use of the mosquito net. He is also strongly of opinion that anything which tends to lower the vitality of the individual renders him more liable to the disease, and he therefore suggests that the use of fermented liquors and of hemp should be prohibited. He further recommends that the employers of labour within the district should do all in their power to prevent communication between affected and unaffected villages, as he regards this as one of the most important means by which the disease is spread.

Human Infection by Dog-Mange.—*Brit. Med. Jl.*, 22nd Feb. 1913, p. 407.

Dr. A. Whitfield and Mr. F. Hobday describe in the Veterinary Journal 17 cases which have come under their observation of the transfer of mange from the dog to the human subject, though the parasite is exceedingly difficult to find. Cats are subject to the same disease and the acarus has been demonstrated in crusts taken from them. The ordinary treatment for human scabies is quite efficient. In one case, seen in private practice, the patient had had the disease three times; he was treated for scabies, but his dog suffered from what was called eczema.

Nematodes in the Production of Cancer.—*Brit. Med. Jl.*, 22nd Feb. 1913, pp. 400-402.

In cancerous and other tumour formations certain animal parasites have occasionally been observed either in the growth itself or in its surroundings, and there is some ground for the assumption of a causal relationship. The literature of cancer contains many references to the presence of nematodes in human cancers, but it has generally been assumed that such concurrence was accidental. Borrel has held that *Demodex*, nematodes and *Cysticercus* may be the carriers of an unknown virus and has connected them with the tumours of mice; he has also found *Demodex* in early epithelioma of the face and in carcinoma of the breast in the human subject. Tsunoda has shown that *Demodex* may exist in the nipples of women without necessarily producing cancer; and Haaland has found the mammary glands of old mice to be frequently infested with nematodes, which appeared to set up interstitial changes which might be the forerunners of malignant growth. Prof. Fibiger, of Copenhagen, communicates to the *Berliner Klinische Wochenschrift*, of 17th February 1913, the results of a long series of observations on rats which tend to show that a nematode parasite may give rise to malignant tumour in these animals and that the intermediate host is the cockroach.

He made autopsies on three rats in 1907, in the course of some investigations on tubercle, and found their stomachs to be the seat of large papillomatous growths, probably malignant in character, injection of the material of which into other rats yielded negative results. Histological examination of the tumours revealed the presence of an hitherto undescribed species of nematode. A further examination of no less than 1,144 rats resulted in the finding of only 11 which showed anything approaching the conditions originally found and none in which those conditions could be said really to exist. Nematodes were found in 23 cases, but none resembling those found in the original three rats. With great difficulty these three rats were traced to Dorpat, in Russia, and a communication from Galeb to the effect that the cockroach, *Periplaneta orientalis*, was the intermediate host of a *Filaria* found in the stomachs of rats, led to the investigation of a large number of wild rats (*Mus decumanus*) in whose stomachs this cockroach was found; no nematodes were however discovered. Rats from a sugar-refinery, which had fed upon another species (*Periplaneta americana*), yielded positive results; in 40 cases out of 61, nematodes were found; in 18, the stomachs showed pathological changes; and 9 showed advanced tumours of the same type as those originally found, which was regarded as strong *primâ facie* evidence of a connection between the nematode, through the cockroach, and the disease. Fifty-seven rats bred and reared in the laboratory were then fed on *P. americana* from the sugar-refinery, during periods varying from 5 to 25 days, the largest number given to any one animal being 94. These rats were isolated and only examined when they died, with the result that nematodes were discovered in 54 cases; in 18 of these there was no disease, but in 36 pathological changes had occurred; these were very marked in 7 cases and identical with those originally observed. Eggs were found in the excreta, but no embryos, and none developed even when kept for 6 months, nor could rats be infected with these eggs; the cockroach was necessary for the development of the embryo. Experiments on the transfer of these eggs to the previously nematode-free cockroach (*Periplaneta orientalis*) were perfectly successful;

the eggs developed and of a further series of 11 laboratory-bred rats allowed to feed on these infected cockroaches, 7 showed nematodes, and in three of these the hyperplasia of the stomach was marked; 43 laboratory-bred rats fed on non-infected cockroaches yielded negative results. Prof. Fibiger has no doubt whatever, as the result of careful microscopical examination, that, in the advanced cases, he was dealing with true malignant tumours. The association of *Bilharzia haematobia* with vesical carcinomata is known, but this is the first occasion on which a malignant tumour has been produced experimentally.

HALL (M. C.) & MUIR (J. T.). **A Critical Study of a Case of Myiasis due to** *Eristalis.*—*Archives of Internal Medicine, Chicago,* xi, no. 2, 15th Feb. 1913, pp. 193-203.

One of the authors was called professionally to see a boy, aged five years, who had been ailing about 10 weeks and was under treatment for indigestion and obstinate constipation. The emaciation seemed to be due to the fact that the boy had for some time vomited almost everything he ate. Medicine was prescribed, but the mother purchased and administered a proprietary worm remedy. The stools were passed the same evening and with proper precautions to prevent the introduction from outside of any visible organisms; when examined they were found to contain one of the "rat-tailed larvae," the larva of a fly of the family SYRPHIDAE. As it is a question whether Dipterous larvae can survive the digestive process of the alimentary canal and pass out in the faeces alive and uninjured, the case is of some interest. There are very few records of such occurrences and in many cases, especially those occurring in the country, there is always considerable room for doubt as to whether the larvae found had been passed by the patient or had got into the faeces from outside. Banks remarks that the number of Dipterous larvae which occur in decaying fruits and vegetables and on fresh and cooked meats and other articles of food is so great that large numbers must be swallowed by persons every year, and generally without any serious consequences. The authors quote fifteen more or less well authenticated cases of various Dipterous larvae, chiefly *Eristalis,* which have passed through the human alimentary canal uninjured. In the particular case under consideration, the child confessed to having drunk water from a ditch full of all manner of rotting matter. Reasons for believing that this particular larva had passed through the alimentary tract are given at some length, and it is stated that there was no reasonable possibility of its having reached the faeces from the outside. Syrphid flies were particularly numerous round the boy's dwelling place.

The authors give the following list of larvae as having been found, without doubt, alive within the human body and conclude with a bibliography of the subject. Odhelius's case of *Helophilus pendulus*; Wagner's case of *Eristalis arbustorum*; Leidy's case of *Eristalis sp.* (nasal); Riley's case of *Eristalis dimidiatus* and of *E. tenax*; Shattock's case of *E. tenax*; and McCampbell and Corper's case of *E. tenax*.

Würtz (—). **Moustiques et fosses d'aisances.** [Mosquitos and Cesspools.]—*La Caducée*, 15th Feb. 1913, p. 50.

The author, at a meeting of the Société de Médecine et d'Hygiène Tropicales, pointed out the important *rôle* of cesspools in the propagation of mosquitos. In a hospital for the aged he found that there were periodic outbreaks of great numbers of insects of the genus *Culex*. For three years search was made without result for the place in which they developed, in cisterns, gutters and water-tubs. The neighbouring sewers, which had never been attended to, were examined and no larvae were found. By accident it was discovered that quantities of mosquitos were coming out of a ventilating pipe from one of the hospital cesspools into which sink- and washing-water also flowed. The reaction of the water was alkaline; the use of petroleum promptly stopped the nuisance.

Pech (M. J.). **Note sur l'étiologie de la fièvre typhoide.** [Note on the etiology of typhoid fever.]—*La Caducée*, 15th Feb. 1913, p. 48.

The writer points out that one of the most energetic sterilisers in the case of military latrines and similar places is the ammoniacal fermentation and that, objectionable though this may be from many points of view, it operates actively in preventing the spread of typhoid fever by flies which settle and develop in these places. He has himself no doubt whatever as to the distribution of what he calls "pollen typhoïdique" by insects and urges that anything which will prevent them from carrying about the poison of typhoid is valuable.

Todd (J. L.). **Tick Bite in British Columbia.**—*Canad. Med. Ass. Jl.*, Dec. 1912. (Reviewed in *Jl. Trop. Med. & Hyg.*, 15th Feb. 1913, p. 58.)

A very fatal disease, with symptoms closely resembling those of typhus, occurs in some parts of Montana, and is known locally as "spotted fever" or "tick fever" because it is transmitted by the bites of a tick.

It having become known that this tick, *Dermacentor venustus*, exists in Southern British Columbia, enquiries were made by circularising two hundred doctors as to whether a similar disease existed in Canada. Forty replies were received. Many of these stated that the wound caused by a tick bite was frequently followed by severe local inflammation. Six reported paresis or paralysis and sometimes death as a result, but the symptoms reported in these cases were quite unlike those of the tick fever of Montana. Some of these cases go back as far as 1898.

Christophers (S. R.). **Malaria in the Andamans.**—*Sci. Memoirs by Officers of the Med. and Sanit. Depts. of the Govt. of India.* (N.S. no. 56.) (Reviewed in *Jl. Trop. Med. & Hyg.*, 1st Feb. 1913, p. 41.)

The author states that the chief carrier of malaria in the settlement is *Anopheles* (*Nyssomyzomyia*) *ludlowi*, a species which breeds in and about salt-swamps and which is never found further than half a mile from salt or brackish water.

The form of parasite carried by this *Anopheles* was malignant tertian, though it is probable that it carries all forms. It is doubtful whether malaria is transmitted by the other common species, *A. rossi* and *A.* (*Myzorhynchus*) *barbirostris;* in any case, the latter species can only be an important carrier within the forest, and the mere clearing of the land has made it of small consequence even in regard to numbers.

Owing to the distribution of *A. ludlowi*, malaria in the settlement is confined to a belt around the harbour and is absent, or nearly so, from villages more than half a mile from the sea-coast or the salt-swamps connected with it. This freedom from malaria is evident even in inland villages, on the margins of swamps, amidst rice-fields and near jungles, and in some cases within the villages themselves the portions lying nearest to the sea were malarious, while those further away were not.

The endemicity of the disease is clearly associated with the prevalence of *Anopheles*. Suitable breeding conditions were unlimited, but fish of the genus *Haplochilus* were very common, and found in all waters, except those of a purely temporary character.

It is of interest that though at the time of the visit there were very few cases of infection with malignant tertian, the only two infected *Anopheles* found carried this type of parasite.

Christophers thinks that the proportionate prevalence of the different forms of parasites in any community is dependent upon. (*a*) the activity of transmission (number of *Anopheles* carriers); and (*b*) factors which increase or diminish the number and continuance of relapses.

Longfellow (R. C.). **The Common House Roach as a Carrier of Disease.**—*American Jl. of Public Health*, iii., no. 1, Jan. 1913, pp. 58-61.

Experiments made with a number of cockroaches showed that these insects carry on their legs *Bacillus coli communis*, *B. proteus vulgaris*, *Staphylococcus aureus*, *S. citreus* and a bacillus of the *subtilis* type.

The same organisms were found in the faeces. The author was able to prove that the cockroaches will eat and live upon the faeces of other cockroaches, that many of the organisms found either on the limbs of the insects or in their alimentary tract were not affected by passage through the alimentary tract, and experiments made with a number of other organisms obtained from outside sources yielded the same result. He points out that these experiments show the common cockroach to be a very possible carrier of infection, and that it is almost of as much importance to prevent the multiplication of cockroaches as of house-flies.

Bouet (—), & Roubaud (E.). **Mission de la Prophylaxie de la Fièvre Jaune au Sénégal. Instructions relatives à la Lutte Antilarvaire.** [Mission for the Study of the Prophylaxis of Yellow Fever in Senegal. Instructions for operations against Mosquito larvae.]—*Annales d'Hyg. et de Med. Coloniales*, xv, no. 4, 1912, pp. 742-750.

The authors remark that in the course of their mission they have observed only too often that the operations for the destruction of mosquito larvae were frequently without result, despite their great importance for the health of the country, owing to want of knowledge on the part of the persons to whom the work was entrusted. They therefore thought it desirable to issue some definite instructions on the subject. The larvae of various mosquitos:—*Anopheles*, *Culex*, *Mansonioides* (*Mansonia*), *Ochlerotatus* (*Catageiomyia*), and *Stegomyia* all develop in different environments which it is most important should be known. The authors divide them into pool mosquitos; mosquitos breeding in marshes of large area and in lagoons; mosquitos breeding in crab-holes; and mosquitos breeding in domestic utensils.

(1) *Pool Mosquitos—Anopheles.*—The larvae of these are found in ditches filled with herbage, water-holes in which the water is muddy and greenish, and small pools containing algae with herbage on the bank; abandoned clay pits and such-like places which fill with water in winter-time become the breeding places of *Anopheles* in the immediate neighbourhood of villages. The larvae of these mosquitos are also frequently found in quantities in large artificial receptacles, such as the bottoms of boats, canoes, etc. They may be immediately recognised by their position parallel with the surface of the water. The destruction of larvae found under these conditions and in such places is of great importance as against malaria, but does not affect the question of yellow fever.

(2) *Mosquitos Breeding in Marshes of large area and Lagoons.*—Large mosquitos, especially *Mansonioides*, breed in enormous quantities in these places and, driven before the wind, they sometimes infest towns and villages situated in the neighbourhood of inundated areas very seriously. The only effective method of fighting these insects is drainage on a large scale. Fortunately these mosquitos do not enter into the problem either of paludism or of yellow fever, and they are only of secondary consequence on account of the great annoyance which they cause.

(3) *Mosquitos Breeding in Crab-holes.*—Many species of mosquitos inhabit the holes dug by land-crabs, more or less close to the sea or to brackish water. The only method of attack is by the oiling of each of these holes individually, and this can only

be effected in the interior of courtyards, gardens and in the immediate neighbourhood of dwellings. These mosquitos again are of secondary consequence.

(4) *Mosquitos Breeding in Domestic Utensils.*—The larvae of mosquitos which are found in the midst of inhabited centres either in abandoned domestic utensils, or even those which are actually in use, are those which especially demand the attention of the sanitary staff. By far the largest proportion of the mosquito larvae found in the water collected in these vessels, are the larvae of *Stegomyia* and the sanitary staff should examine all pails, barrels, jars, cisterns and every kind of article, however small, capable of containing water, in the interior or in the neighbourhood of houses; empty tins, the bottoms of railway waggons, all hollow bricks, in fact, everything that by any possibility could contain a little water. The detection of the larvae is not always easy at first. The members of the sanitary staff frequently content themselves with the examination of a sample of water taken from a suspected receptacle. This plan is utterly insufficient and thoroughly bad. The receptacle itself must be carefully examined throughout, and, if need be, removed from its position into full daylight, so that there shall be no doubt of the thoroughness of examination. The members of the staff should be accustomed to this mode of operation, which is often not altogether acceptable to the inhabitants of the houses. The existence of a wood, metal, stone or even a cement cover to a vessel containing water should not be regarded as sufficient excuse for omitting the same thorough examination, for, unless such covers are absolutely air-tight, there is sure to be some crack through which the mosquito can find access to the water within. The presence of larvae is very frequently announced before the examination, by mosquitos flying out of the vessel when the cover is lifted. The greatest attention should be paid to receptacles which are constantly placed in the shade. Those which are fully exposed to the sun, especially if of metal, are not worth inspecting, but if there be any that have deposits of moss or of algae on their sides, inspection should be thorough. Vessels in which the water is constantly fouled by dust in sufficient quantity to form a deposit on the surface rarely contain any larvae. In villages, tubs and jars used for the preparation of indigo should be specially investigated. The time required for the fermentation of solutions of indigo is 10 days. It will therefore be sufficient, and will prevent interference with the native industry, if care be taken that the solutions in these tubs is renewed every 10 days. Irrigation cuttings should be inspected with care, especially if there is any tendency for the water to stagnate, but in these and smaller channels if the water is renewed and circulates for at least a few hours per diem, the larvae will not develop. The spathes of pineapples, bananas, coconut palms and garden plants do not require much attention, because the number of larvae which can develop in them is trifling compared with those found in other places more easily controlled. All holes in trees should be most carefully examined. Wells with cemented sides should be looked after, especially if not in use, whether they have a cover or not. Wells which are lined with hollow bricks or badly

jointed stones present abundant hiding places for the larvae. A reddish larva is constantly found in these wells which produces an imago of a green colour which does not bite (*Chironomus*). It is of importance that the discovery of these larvae by native agents should not be made use of to the annoyance of the inhabitants as they are found everywhere and are harmless. The sanitary staff has two duties to perform, the destruction of the larvae themselves and the destruction of their breeding places. When the larvae have been found it is best to destroy them immediately by the use of petroleum, if the receptacle happens to be fixed and cannot be thoroughly emptied and cleaned; but if it can be removed and emptied the greatest care must be taken that all the water is drained from it and the interior thoroughly dried, because the larvae and the eggs will remain adhering to the walls of the vessel, and unless they have been killed by the drying and cleaning process, the labour will be thrown away if the vessel be refilled with fresh water. In addition to all the obvious precautions to be taken with regard to empty tins, broken bottles, etc., the staff should cement up the holes in the trees, and see that all water-courses, especially the small ones, are clear, so that the water runs continuously; in the towns, all works of construction in progress and all store-houses and work-shops in the open air should be frequently visited and any article which could possibly collect water carefully examined. It is also very important to persuade the inhabitants to reduce the number of water-containing vessels as much as possible. The writers conclude these instructions with advice as to the division of the work and the supervision of the men engaged in it, and as the period necessary for the development of *Stegomyia* is from 8 to 10 days, if the staff be so divided that in each section it shall be possible to empty all water-receptacles once a week and clean them thoroughly, it is probable that a maximum of efficiency will be procured.

Skelton (Capt. D. S.) & Parham (J. G.). **Leprosy and the Bed-bug.**—*R.A.M.C. Journ.*, xx, no. 3, March 1913, p. 291.

The authors remark that insects and biting flies have been suspected as being the carriers of the infecting agent of leprosy: *Chlorops leprae*, *Sarcoptes scabei*, *Pediculus*, mosquitos and bed-bugs have all been suggested, and they determined to see if acid-fast bacilli could be found in bed-bugs taken from the beds of lepers in the Government Asylum in Zanzibar.

Sandes found acid-fast bacilli in the alimentary canals of 20 out of 75 bugs examined. Seventy-five bugs (*Cimex lectularius*) were teased out and examined, and in a second experiment one hundred further bugs were examined, one of the authors having previously systematically examined five hundred bugs in addition. The authors arrived at the conclusion that it is exceedingly improbable that the bed-bug plays any great part in the transmission of the disease in Zanzibar, as in only two films were they able to detect anything which at all corresponded with the organisms described by previous writers.

YAKIMOFF (W. L.) & KOHL-YAKIMOFF (Nina). **Canine Leishmaniasis.**—*Zeits. f. wiss. prakt. Veterinärmedicin, Dorpat, Russ.*, 1912. (Reviewed in *Ann. Méd. Vét. Cureghem*), no. 1, Jan. 1913, pp. 28-29.

The authors examined the bodies of 299 dogs in Tunis and discovered the organisms of leishmaniasis in five. They are of opinion that ticks are not the carriers of the infection, as in none of the cases examined does this appear to have been possible.

ROUBAUD (E.). **Relations bio-géographiques des Glossines et des Trypanosomes.** [The bio-geographical relations of *Glossina* and Trypanosomes.]—*Bull. Soc. Path. Exot.*, vi, no. 1, 1913, pp. 28-34.

The author refers to the results of work done by himself in 1906 to 1908 in which he recorded the inconstancy and rarity of salivary infection by trypanosomes in *Glossina* and the conclusion at which he arrived that local climatic conditions possibly had a considerable influence in bringing about this irregularity, and also that it might be possible that races of flies existed characterised by different properties in regard to the development of trypanosomes in their salivary glands. Practical experience has shown that not all tsetses which are allowed to bite an infected person develop trypanosomes in these glands. He has also observed that in Lower Dahomey, *T. cazalboui* predominated in *G. longipalpis* and *palpalis*; *T. dimorphon* in *longipalpis* and *tachinoides*; *T. pecaudi* in *longipalpis*. In Upper Dahomey *T. pecaudi* predominates in *G. morsitans*; in Casamance *T. dimorphon* was the most widespread form and was found especially in *G. morsitans*. Inasmuch as the flies obtain the infection from a great variety of animals whose mode of life is practically the same, the difference in receptivity of the flies would appear to depend upon what the author calls the bio-geographical conditions to which the flies themselves are subject, and he has made observations on *G. palpalis* in relation to *T. cazalboui* in different districts which more or less accord with this theory. Thus at Brazzaville, Middle Congo, 4·8 per cent. (41 flies) were found to be thus infected; at Agouagon, Central Dahomey, 40 per cent.; at Kolda, Upper Casamance, 0 per cent. For the same, or for an analogous virus, Bouffard gives 38·6 per cent. at Bamako, in the French Sudan; while in Uganda Bruce and his co-workers recorded 20 per cent. for *T. vivax*. These differences are especially marked between *G. palpalis* from Central Dahomey and Bamako (which are easily infected in apparently the same proportions) and those of Upper Casamance which under the same seasonal conditions (dry season) he has never been able to infect in a single case, in spite of repeated attempts on infected animals of different kinds. These remarkable differences of receptivity, obtained experimentally, are absolutely confirmed by the examination of the natural conditions of infection with *T. cazalboui* of flies captured in the open in these same localities. At Kolda out of 560 flies captured and examined only one case of infection of the proboscis could be noted, whilst at Bamako and Agouagon *G. palpalis* is naturally infected in a very high degree (1 in 30 to 1 in 50). Observations on *T. gambiense* have produced a similar result in Dahomey and in Casamance; 1,200 *G. palpalis* were examined and not one was found to be infected. In Dahomey human trypanosomiasis is unknown and it is not of frequent occurrence in Casamance.

Kleine in East Africa and Bruce and his co-workers in Uganda have obtained 5 per cent. positive results with considerable ease from a very much smaller number of *Glossina*. Kinghorn and Yorke have similarly found great differences in Rhodesia. Kleine and Fischer obtained 2 positive results with 1,400 flies on Lake Victoria, and Taute found 4 per cent. of positive results on the shores of Tanganyika. It would thus appear clear that the receptivity of a given species of *Glossina* for a given virus is not constant throughout the whole area inhabited by that species. Geographical distribution and receptivity of different species have no necessary connection. Most writers consider that climatic factors exercise an influence on the development of the virus in *Glossina*. Roubaud is however of opinion that this influence is only indirect, producing in the flies physiological modifications in their salivary apparatus, rendering it fit or otherwise for the development of the parasite. Thus in Dahomey he has shown that under identical climatic conditions some species will develop the virus and others will not, and this limitation of receptivity on the part of the insect naturally limits the distribution of the disease. The migrations of the flies, which Roubaud has shown to be very important, especially at the commencement of the winter season, produce constant interchanges of *Glossina* between zones of receptivity and zones of non-receptivity. The virus thus transported by infected flies outside their normal zone will be diffused in the neighbouring zone and in the author's opinion this explains the existence of sporadic cases of trypanosomiasis in certain regions where, in spite of the great numbers of *Glossina* and the abundance of game, the existence of the virus is restricted to human beings and domesticated animals. In these areas, which the author calls zones of diffusion, he considers that the infected flies come from surrounding infected districts. Within these zones not only is the absolute number of cases small, but the cases themselves are frequently observed to be less severe, and these conditions Roubaud thinks may possibly lead to the disinfection of the flies in course of time, in the same way as has been observed in the laboratory. It thus results that the mere presence of large numbers of *Glossina* in any given district does not *a priori* condemn the area as uninhabitable for man or domesticated animals, and the introduction of the poison into a tsetse-belt where it did not previously exist is not necessarily a source of danger; that is to say, the tsetse in that zone *may* not be receptive, and so long as the local biological conditions remain undisturbed, these flies will remain uninfected.

Every attempt at the suppression of *Glossina* must be governed by a proper consideration of these facts; that is to say, it is against the belts of receptivity that action should be directed, and, in order that the work of cutting down brushwood and deforesting may not be thrown away, the tsetse-belts should be carefully examined beforehand as to their receptivity or otherwise, or at least some information should be obtained as to the exact value of their infective power.

Legendre (J.). **Destruction des culicides à l'aide du filet.** [Destruction of Culicidae by means of nets.]—*Bull. Soc. Path. Exot.*, vi, no. 1, 1913, pp. 43-47.

The author is of opinion that the use of a hand-net for keeping down mosquitos is a method not to be despised. He advises the use of one 50 cm. x 30 cm. in the opening, the net to be 70 to 80 cm. deep. He originally described his net in *Bull. Soc. Path. Exot.*, 1910, p. 457, and now gives an account of results obtained by its use in Hanoi, Tongking, where mosquitos abound.

The experiments were made in the hospital in a room, the window and door of which were screened, with a total capacity of 47 cubic metres, containing a bed and its mosquito net and two small tables. The interior was lime-washed, except the lower part, which was painted black up to 18″ above the floor. Experiments were made by closing the room and letting loose in it a large number of mosquitos. An attendant was set to work to capture them with the net, and in from half to three-quarters of an hour the whole of the mosquitos let loose in the room had been captured. The results of four such experiments are reported.

The writer says that the net should be used quietly, and he thinks that the plan is worth considering as a means of removing mosquitos from the room without annoyance to the patient. He says that all that is necessary to be done by way of preparation is carefully to close the doors, windows, and other openings, but that it is not necessary to do more than this, and he recommends the method strongly in those cases in which fumigation cannot be practised.

Reckoning mosquitos at the rate of 900 to the gramme, and weighing the catch, his own servants captured in one season 60,000 to 80,000 insects by the use of the net.

Bernard (P. Noel) & Bauche (J.). **Conditions de propagation de la filariose sous-cutanée du chien.** *Stegomyia fasciata* **hôte intermédiaire de** *Dirofilaria repens*. [Conditions of propagation of subcutaneous filariasis in the dog. *Stegomyia fasciata* the intermediate host of *Dirofilaria repens*.]—*Bull. Soc. Path. Exot.*, vi, no. 1, 1913, pp. 89-99.

In the district of Huë (Annam) subcutaneous filariasis appears to the authors to be a common affection, while vascular filariasis is rare. In nearly four hundred dogs whose blood was examined they were unable to diagnose *Dirofilaria immitis*. The post-mortem examination of twenty-five other dogs, showed that the great majority were suffering from the subcutaneous form of the disease. The authors also observed that the number of dogs so attacked varied very materially in different quarters of the town;

on the outskirts beyond the ramparts 2 per cent. were infected, whilst within the native town proper, entirely surrounded by high fortifications, the proportions were from 25 per cent. to 30 per cent., and this notwithstanding that the number of dogs in proportion to the number of inhabitants is practically the same all over the town.

The insanitary conditions due to ponds, stagnant water, and organic filth around the houses are the same everywhere, only the houses in the citadel and its immediate neighbourhood are closer together, better sheltered from wind, and to a certain extent from variations of temperature. The population is also denser. The dogs in all cases roam about the houses at will, and rarely or never go out into the surrounding country, and this leads to the conclusion that canine filariasis is transmitted by some agent which exists in human dwellings, and that it there finds the most favourable conditions for its development.

Ticks (*Ixodes ricinus*) and *Hippobosca* (*H. capensis*) by reason of their abundance first attracted the authors' attention, some dogs being found literally covered with them. Tabanids, *Stomoxys*, etc., only rarely bite bogs, and the authors on examination failed to find any organisms in them.

They carried out experiments in the following manner:—A large cage 3 × 1 × 1 metres, entirely closed, with glass windows and wire gauze walls, was divided into two compartments by coarse wire-netting through which flies could pass easily. In one compartment were placed vessels containing the larvae of mosquitos collected about the Annamite houses in those quarters where dog filariasis was common. The cage was placed under a veranda, so that the conditions under which the insects were placed were as nearly as possible similar to that of their usual environment. Forty-eight hours after the insects developed from the larvae, a dog suffering from filariasis was introduced into the large cage with the insects. The female *Stegomyia* attacked it vigorously, gorging themselves with blood and then resting on the walls of the cage where it was easy to take them. All the insects which had bitten the dog on one and the same occasion were collected in a cage and fed with water and bananas, and the development of the *Filaria* was followed in their bodies by the dissection of one of their number at frequent intervals. It was discovered that the embryo required nine days, at 31-35° C., to pass from the microfilaria stage in the stomach to that of the larva in the proboscis; these early metamorphoses take place in the Malpighian tubes, as other writers have demonstrated to be the case with *Dirofilaria immitis*. They then traverse the thoracic muscles and lodge themselves in the proboscis where they behave in the same way as has been observed of *F. bancrofti* in *Culex* and *Anopheles* by various writers. The authors never found more than four or five *Filaria* in the thoracic muscles of the same insect even when the original infection was gross. The development of the embryo in the intermediate host is greatly affected by the temperature. In June, July and August metamorphosis was complete in nine days in a laboratory temperature of 25° C. to 30° C. When the temperature in September ranged from 21° C. to 23° C.

in the same place, metamorphosis was hardly complete in fifteen days; the number of mosquitos was also less and the filaria remained for the most part at the second or third day stage. Between 29° C. and 30° C. the *Stegomyia* die in twenty-four hours.

Examination of the mosquitos collected showed that if *Culex* and *Anopheles* took up the blood of the dog under observation the development of the *Filaria* took place in *Stegomyia* only. This particular mosquito presented all the characters of *Stegomyia fasciata*, F., and was identified as such by A. Krempf of the Pasteur Institute at Nhatrang, and the authors think that whatever part other mosquitos may play in the spreading of the disease, this *Stegomyia* is the most important agent in its distribution.

It appears to the authors probable that infection by *Stegomyia* takes place especially during the warmer and moist season when the rains are not very serious, that is to say, between April and August; the conditions from September to March with great variations of temperature, violent gales, and torrential rains being prejudicial to the mosquitos.

Having thus established to their own satisfaction the fact that *Stegomyia fasciata* can take up *Filaria* from the blood of an infected dog, and that the organism is capable of completing all the stages of its development within the body of the fly, the authors reversed the order of experiment and caused a number of the mosquitos which had been allowed to infect themselves ten or fifteen days previously to bite six puppies of ten days old, whose blood showed no traces of the disease, the mother being also free from it. Every morning for fifteen days the dogs were bitten by four or five mosquitos, which gorged themselves with blood, generally remaining attached for five minutes. The puppies were then enclosed with their mother in a large cage in which six other control dogs of the same age were also living. All the dogs which had been bitten succumbed within thirty days after probable infection. The controls survived.

The authors make some further observations as to the age at which dogs in the town appear to be chiefly infected. Out of three hundred examined, the youngest were a year old, and those most seriously attacked more than three years, and it seems probable that young dogs living in the native houses cannot defend themselves against biting insects so easily as the older ones. In those quarters of the town where 30 per cent. of the dogs of all ages were affected, 50 per cent. or 60 per cent. were less than a year old.

East Coast Fever in Nyasaland.—*Ann. Rept. Dept. Agric., Nyasaland,* 1912, pp. 31-36.

Mr. Garden, the Veterinary Officer, reports that the disease of cattle which appears to have been prevalent for a number of years in Momberas country is identical with East Coast Fever and *Piroplasma parvum* was found in every case in which Koch's granules were discovered. The disease is known to the natives by the name of "chigodoro," which signifies "swellings." A disease with the same name was reported from Livingstonia, North Nyasa, and on his way thither the Veterinary Officer examined numbers of cattle at intervals with the same result. He obtained evidence that this disease had been very prevalent in North Nyasa for a number of years before it reached Momberas and that the majority of the cattle there are now immune to it. At villages in which there had been great loss for two or three consecutive years it was observed by the natives that adult cattle now escape and that only calves are attacked, of which a percentage recover; again, where they have escaped the disease altogether until now, adults as well as young stock are attacked.

The Brown Tick, *Rhipicephalus appendiculatus*, is very prevalent in Momberas country, in North Nyasa and also in the Zomba and Blantyre districts. It has been clearly shown that if an infected area be kept absolutely clear of cattle for 14 months it may then be safely re-stocked, and the Veterinary Officer is of opinion that this practice should be carried out. At the same time he points out that there are probably still a few small areas in Momberas country which have not yet been visited by the disease and to which it will certainly find its way in due course, but eventually this will be for the common good of the cattle industry of the district by still further increasing the already very general immunity. Nevertheless the clearing of infected areas for 14 months at a time should be practised. There is no reason to suspect the existence of the disease in Zomba and Blantyre at present, but it is possible that it occurred in these parts before it was heard of in the northern district.

From the Mpasassi to the Dwangwa and also in a large area on the south bank of the Dwangwa, there are no cattle. The grazing is fairly good and the Veterinary Officer thinks this would make a very suitable quarantine area for the removal of cattle from Momberas. The eradication of the ticks from an infected area should be assisted by burning the grass. The grass should be preserved unburnt as long as possible till just before the rains commence, thus giving an opportunity for as many of the ticks as possible to hatch out and attach themselves to the grass in waiting for a host, when they cannot escape the ravages of a grass fire.

If the grass be burnt too early the eggs and newly hatched ticks will still be hidden in the ground or under stones and will to a very large extent escape the effects of the fire.

HADWEN (Seymour). **Preliminary note on the finding of *Hypoderma bovis* at Agassiz, B.C., together with notes on the Biology of the Fly.**—*Proc. Br. Columbia Entom. Soc.*, 1912, pp. 81-82.

Up to the present time *Hypoderma lineata* has been considered to be the warble-fly of North America. During the summer of 1912 six specimens of *H. bovis* were captured attacking cattle, and seven flies were bred from pupae. The average time taken for the emergence of flies from the pupa was 34·7 days. This is the first record of the species for Canada, and probably for North America.

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Blacklock (Dr. B.). On the resistance of *Cimex lectularius* to various reagents, powders, liquids, and gases.—*Ann. Trop. Med. Parasit.*, vi, no. 4, 30th Dec. 1912, pp. 415-428.

The author remarks that in many cities and villages, the bed-bug is more or less tolerated as being at least a harmless creature, although recent investigations tend to show that this is far from being the case. A position of safety appears to be a matter of prime consideration to the insect, and being a very rapid walker it is able to take shelter at a considerable distance from its feeding ground. Thus iron bedsteads, though a great advantage, are not in themselves a sufficient means of dealing with the pest. Unlike ticks, the bed-bug does not take a long time to feed. It runs rapidly from place to place, halting here and there for a few seconds to suck blood. Bugs can subsist for a long time without food; they have been kept alive in the laboratory for three months easily in a test-tube fitted with a cork; they will even moult under these conditions.

Simple methods of obtaining the eggs of bugs are given, together with the author's observations as to the period of incubation, which he found to be, on an average, seventeen days at the laboratory temperature, of June, July, and August; fourteen days at 22° C., and 10 days at 25° C. Twenty-four hours immersion in cold water prevented them from hatching. The larvae begin to feed within a hour or two of emergence, and in order to feed them safely the shaved skin should be as dry as possible, otherwise the antennae and legs become glued together and they die. The larvae are not capable of resisting much heat; 150 unfed larvae have been known to die within five minutes on being exposed to a temperature of 45° C.; the adult bug can resist this temperature somewhat longer.

The author tested the effect of powders, (*a*) by placing the bugs in a clean "petri dish," and sprinkling the powder over them; (*b*) by sprinkling the powder over the dish, and then placing the bugs in it; (*c*) by making a ring of powder in the bottom of the dish a quarter of an inch wide, with an open centre as large as a five shilling piece, and the powder a sixteenth of an inch deep; the bugs were placed in the centre of the ring, and any that passed through it were collected and placed in a clean dish for observation; (*d*) an island of powder was placed in the centre of the dish, and the bugs outside it, those which touched or walked through the powders and regained the clear area being examined; (*e*) same as (*d*), but pieces of blotting-paper were placed in the dish to shelter the insects.

Experiments on eggs were made by placing them in powder for an hour, then removing them and placing them in small capsules. Other eggs were placed upon a layer of the powder under trial on the bottom of the dish, and the effect on hatching observed.

The following is a list of the powders tested: Keating's, Hawley's I.K., Danzo Powder, Cimo Bane, Jacko Dust, Val's Beetle Cure, and Steiner's Genuine Dalmatian Insect Powder.

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Methods (*a*) and (*b*) were most effective, owing to the prolongation and certainty of contact, and the insect rarely escaped death; (*c*) and (*d*) were not so successful, some insects recovering and feeding and depositing ova in contact with the powder; (*e*) did not prove a satisfactory method of trial. The certainty with which a given powder will kill bed-bugs was found to depend chiefly upon: (1) fine subdivision of the powder; (2) its dryness; (3) its lightness. Methods (*a*) and (*b*) will kill bugs with great certainty, the action being apparently, in most cases, purely mechanical. If the bug be sprinkled with the powder, it becomes coated over with fine particles, adhering to the body, antennae and legs. After struggling for a time the insect turns over on its back and in this position it struggles until it dies, the period varying from a few minutes to several days. Details as to the action of several powders are given. The author says in regard to these insect powders in general, that they are very fatal to bugs, and will destroy them with considerable certainty if applied by methods (*a*) and (*b*), while they are partially successful by methods (*c*) and (*d*). Method (*e*) clearly shows that these powders must fail radically to exterminate the bugs under natural conditions, as there is nothing to compel them to come out of their hiding place and seek food, and consequently they escape the powders which are strewn on their supposed path. The powders appear to have no effect upon the eggs. The larvae hatched from eggs covered with the powder generally die.

Besides the above, various other powders were tried: French chalk, pulv. rhei., pulv. jalapae, Dalmatian flower powder, pulv. cort. ulmi., pulv. cinchonae, pulv. sod. brom., pulv. embel., pulv. acid tannic, pulv. amyli, and barium sulphate. Some of these powders had marked effects on adults and newly hatched bugs, when applied by methods (*a*) and (*b*). Dalmatian flower powder and fine French chalk are good insecticides; pulv. cinchonae quickly renders bed-bugs incapable of progression.

A five per cent. solution of carbolic acid killed bugs in ten minutes, immersion for a shorter time only killing a small proportion. A ten per cent. solution killed them in two minutes, but after one minute five remained alive out of thirty.

A solution of perchloride of mercury, one in a thousand, had very little effect. Less than two hours immersion killed none and five and a half hours killed only one in five; while a half per cent. solution was almost equally ineffective, thirteen out of twenty recovering after thirty minutes immersion.

Paraffin oil in five seconds produced sufficient effect on ten bugs tried that, after five seconds immersion, all ultimately died at the end of twenty-four hours. Bugs are capable of walking over wood smeared with paraffin, without harm. The author regards paraffin as the most efficient of all the liquids tried.

Chloroform vapour does not kill, unless the action is very prolonged (3 hours); the vapour of paraffin oil for eighteen hours had little effect; carbonic acid gas paralyses the bugs but does not kill them, all exposed to it recovered; coal gas killed in fifteen minutes; hydrocyanic acid was rapid, and effective, but too dangerous for practical purposes; sulphur dioxide invariably killed in a few seconds. The experiments with this gas were made by six different methods; all yielded the same result. Sulphur dioxide under pressure for two minutes kills with certainty all stages in the cycle of development of the bug, including the egg.

Blacklock (Dr. B.). **The resistance of** ***Ornithodorus moubata*** **to various sheep dips.**—*Ann. Trop. Med. Parasit.*, vi, no. 4, 30th Dec. 1912, pp. 429-433.

These experiments were made with the following commercial dips: Cooper's, Little's, Savar's, Hayward's Yellow Paste, and MacDougall's. Portions of the skin of goats were shaved, the solution applied to the bare skin and allowed to dry before the ticks were placed on it, and the effect noted. They very frequently failed to prevent *Ornithodorus moubata* from feeding on the animal. The ticks were allowed to feed on the shaved skin, and whilst feeding they were thoroughly immersed in the dip solution. The general result was that the sooner the dip was applied after the tick had begun to feed, the more likely was the insect to loose its hold.

The immersion of the ticks in solutions of the various dips, even for periods of an hour and more, in many cases failed to kill. In some cases they survived after very much longer immersion. The author arrives at the following conclusions:—

(1) The dips tested failed very frequently to prevent *Ornithodorus moubata* feeding on the animal; (2) feeding ticks were not easily caused to loosen their hold by them; (3) in test-tube experiments the resistance of this species of tick to these substances in solution is marked; (4) used in the strength recommended and for the time suggested these dips appear to have very slight effect on this tick; (5) possibly other ticks behave in a different manner under these applications.

Drainage against Malaria.—*Bull. de l'Association des Planteurs de Caoutchouc*, v. 13th March 1913, p. 52.

Dr. Watson has invented a special system of sub-soil drainage which results in the rapid extermination of hill mosquitos which breed in running water. This system has been tried in the Federated Malay States, on estates at Phillimore, and at Seafield, and later in the neighbourhood of Kuala Lumpur. It is reported that in each case the results have been most satisfactory and well repay the cost involved.

Lutz (Dr. A.). **Contribução para o estudo das Ceratopogoninas hematofagas do Brazil. Primeira memoria. Parte geral.** [Contribution to the study of the blood-sucking Ceratopogoninae of Brazil.]—*Mem. Inst. Oswaldo Cruz*, iv, pt. 1, 1912, pp. 1-33.

The author gives a general introductory account of the flies of the sub-family Ceratopogoninae, and states that the blood-sucking forms are well represented in Brazil. Certain species are characteristic of the woods and forests inland, while others are confined to the coast-line, being especially prevalent in mangrove swamps. The latter forms are known locally as "maruim." In some places they are such a pest that the inhabitants are obliged to leave the neighbourhood at certain times.

Dr. Lutz has for a long time been of opinion that the breeding-ground of these midges would probably prove to be in the stinking mud of the mangrove swamps. He accordingly examined with great care this mud and the water standing above it, without result. He also carefully examined the bark of the mangrove trees, as well as their aerial roots, without success, and by a process of exclusion, assisted by theoretical considerations, he returned to the examination of the crab-holes which at first had given no positive results. There are many species of crabs inhabiting these swamps, only some of which make holes. These holes are of two kinds; one is dug out of the mud which for the greater part of the day is under water to such an extent that its upper opening is never quite dry, and the hole always contains pure sea water. Another species makes holes in the sand at some distance above the tide-mark, the water in these being generally fresh, or at most brackish, and much cleaner than that in the mud-holes, since it is filtered through sand. Experiments were first made to ascertain whether these crab-holes really were the breeding-places, and for this purpose a large area on the border of a mangrove swamp was surrounded with a screen made of oiled paper to which the insects would adhere. In the larger crab-holes wide-mouthed bottles were placed which were afterwards covered with a bell-jar smeared with a mixture of water, alcohol, and glycerine in equal parts and a little carbolic acid, which kills the insects and at the same time preserves them. The bottles were frequently upset by the crabs and the observations spoilt. He found that the small crab-holes in the mud area gave practically no results. The larger ones on the dry shore yielded a number of specimens of *Culex reticulatus*, sp. n., as well as *Culex corniger*, Theo., and *C.* (*Culicelsa*) *taeniorhynchus*, Wied. Both these species are also to be found in fresh water, but the author found them only on the coast line. On the other hand he obtained no specimens of *Deinocerites*. He next pumped water out of the large crab-holes, and when this was allowed to stand a number of larvae of CERATOPOGONINAE appeared. He also found that if these holes were dug out and the water allowed to settle in them the larvae came to the surface. As a result of a very large number of observations of this kind, he discovered that only one of five species of *Culicoides* inhabited the more or less fresh water in the crab-holes. This species showed little or no periodicity and was but slightly affected by the tides.

The author sought for the other species in the water which circled freely between the mangrove trees, and was able on one occasion to capture a number of free-swimming larvae which yielded three further species. Dr. Lutz believes that the imago only emerges when, with the fall of the tide, the pupa is deposited upon the more or less dried mud. There is not time for this between two spring tides, but it occurs at neap.

The small crab-holes, which are only uncovered at ebb-tide, yielded the larvae as well as the large holes. These larvae live in flooded areas, and it is practically certain that they bury themselves in the mud, and if this be exposed long enough to dry out, they pupate and a few days later the flies emerge. Laboratory observations show that the larval stage may be very prolonged, whereas the pupal stage is very short, which accounts for the few pupae found. The process of oviposition is difficult, if not impossible, to observe, but the author thinks that the eggs are laid on the exposed and partially dry mud. He at first failed to find any other midge larvae, but at length succeeded in discovering two entirely marine species, one a *Forcipomyia*, and the other a *Ceratopogon*, under the mud and the algae covering it; pupae were easily found under the algae covering the aerial roots of the mangrove. Other larvae, closely resembling *C. reticulatus*, were found which had a tendency to bury themselves in the mud; one small, possibly *C. maculithorax*, Williston, and another larger, *C. insignis*, sp. n. These and two other species constitute the most numerous and most troublesome of the midges; the pupae were found in larger numbers by skimming off the top of the mud in the swamp with a shovel.

The author next describes methods for capturing the flies in large numbers. The use of the net was found to give good results for the fresh-water forms. The flies taken on man and the larger animals were mostly females. The search for flies, and especially fully fed females, in houses, stables, &c., did not yield any great results, though they were found in variable numbers on the walls of dark stables in the morning and often when their presence was least to be expected; both sexes were caught on windows, though not often, and the webs of spiders were frequently found to be full of them. No large swarms were ever observed, as is the case with other Chironomids. Lantern traps gave by far the best results. A candle in a spring socket with a glass shade and a metal trough round the outside filled with a mixture of water, alcohol, and glycerine proved a very efficient apparatus for capture. A 50 c.p. electric light, attached to a post 9 metres above ground in the open, yielded good results and a number of new species of *Ceratopogon* and *Palpomyia* were taken by this means.

The general conclusion from these various methods of observation was that the midges appear a day or two before the full and new moon, are plentiful for a few days and then disappear, often more or less suddenly. A high tide may coincide with their appearance in large numbers, but the beginning of their increase is rather connected with the neap tides. In the Bay of Rio de Janeiro the tides are not specially high and their effect is largely disturbed by meteorological conditions, which react on the "maruim" also and produce irregularities in their appearance; the rule given above is therefore of only very general application. The author says that he has observed no periodicity in the species infesting damp woods inland; they appear to be always plentiful and always aggressive, though drought reduces their numbers, and they do not seem to move far from their breeding grounds.

The blood-sucking habit has been observed in the females of a number of genera, *e.g.*, *Tersesthes*, Towns., *Mycteromyia*, Noe, *Culicoides*, Latr., *Johanseniella*, Will., *Ceratolophus*, Kief. The author describes the mode of feeding in *Culicoides* and says that in consequence of the shortness of the lancet this must be buried in the skin close up to the head; the first attempt to insert it does not always succeed and the process is more or less slow, but the quantity of blood taken relative to the size of the insect is large. The article concludes with a description of methods of capture of specimens in the act of feeding and of their preservation, an account of the morphology of the adult insect, and a bibliography.

Lutz (A.) & Neiva (A.). **Contribução para o conhecimento das especies do genero *Phlebotomus* existentes no Brazil.** [Contribution to our knowledge of the species of the genus *Phlebotomus* found in Brazil.]—*Mem. Inst. Oswaldo Cruz, Manguinhos*, iv, pt. 1, 1912, pp. 84-95.

The authors describe three new species of *Phlebotomus* from the districts of Rio de Janeiro, Minas and São Paulo, found in places far removed from human habitation; but a large number of specimens were also taken in woods on the Rio Trombeta (Pará), near the cave of Maquiné in Minas, and on the banks of the Tieté, where they are known under the name of "birigui," and enter the houses freely, being greatly attracted by light. In the open, these flies bite the horse in preference to the rider in uninhabited districts. They are to be regarded as crepuscular or nocturnal in their habits, although in the shade of the woods they fly and bite by day. They are met with in the largest numbers at 500-1000 metres above sea-level, though they are also to be found in quite low-lying localities only a few metres above the sea.

The species described are as follows:—*Phlebotomus squamiventris*, sp. n., *P. longipalpis*, sp. n., and *P. intermedius*, sp. n.

Austen (Ernest E.). **The House-Fly as a danger to health. Its life-history and how to deal with it.**—*British Museum (Natural History), Economic Series*, no. 1, 11 pp., 2 pls., 3 figs. Printed by order of the Trustees, 1913. Price One Penny.

The object of this pamphlet is to set before the public in clear and plain language a description of the house-fly and its habits and to draw attention to it as a carrier of disease. The true house-fly, *Musca domestica*, L., and the lesser house-fly, *Fannia canicularis*, L., are figured and the differences between them pointed out. *Stomoxys calcitrans* and *Muscina stabulans* are also sufficiently described to enable them to be distinguished from the true house-fly. The breeding places and life-history of the insect, its eggs, larva and pupa are described and figured.

The destruction of large numbers of house-flies by the parasitic fungus *Empusa muscae*, Cohn., is noticed. Emphasis is laid upon the fact that these insects breed in and feed on excreta, both animal and human, and that they alight indiscriminately upon these substances as well as upon human food; so that if the former materials should contain pathogenic organisms, the flies will carry them to the food and thus infect the human subject. It is therefore of the greatest importance that flies should be systematically destroyed, and one of the most effective methods of accomplishing this is by preventing them from breeding. The practical difficulties in the way of mixing manure or garbage with chloride of lime and sulphate of iron in solution are pointed out, and the importance of the regular removal of all deposits of stable-manure and household dust-bin or ash-pit refuse *at least once a week* is insisted upon. Since it has been shown that the house-fly is capable of travelling something like a mile, no dumping ground for household refuse of any kind should, if possible, be allowed to exist within this distance of the nearest habitation.

Various methods of killing flies and traps are mentioned, and the use is recommended of formalin, sweetened with sugar, in the proportion of a tea-spoonful to a tea-cup full of water, which is not dangerous to man and gives good results. The pamphlet concludes with a condensed bibliography.

BARLOW (J.). **The House Fly or Typhoid Fly.**—*Bull. Extension Dept., Rhode Island State College*, no. 3, 1912, 12 pp.

As an additional preventive measure against the spread of flies which breed in dust-bins and garbage cans, the author suggests that a hole should be made in the lids of these and a wire fly-trap arrangement fitted in such a way that the flies may escape from the dust-bin when the lid is on by entering the trap from within, as well as from without; the odours emanating from dust-bins, &c., being sufficiently attractive to cause them to congregate on the outside, whilst the arrangement secures the capture of any bred in the interior. When a sufficient number have been collected the wire cage is removed and plunged into boiling water.

CARTER (F. H.) & BLACKLOCK (B.). **External Myiasis in a Monkey.** —*Br. Med. Jl.*, 11th Jan. 1913.

The authors noticed two small groups of dipterous larvae on a specimen of *Cercopithecus callitrichus*, which was suffering from acute tuberculosis and died a day after the observation and the removal of the parasites. One batch was taken from the nose and region of the face surrounding the mouth, the other from the right side of the body near the groin. Twenty-one in all were removed in various stages of development. Three specimens of the blow-fly (*Calliphora erythrocephala*) and seven of *Muscina stabulans* were bred out, together with two of *Fannia canicularis*. These records are of some interest, as neither *Fannia canicularis* nor *Muscina stabulans* can be classed among the flesh-flies, although both, but more especially the former, have been known to occur in the alimentary tract of human beings. There are records of *Fannia* having been reared from the larvae of a lepidopterous insect (*Epischnia canella*), and of its occurrence in the nest of the common Bumble Bee (*Bombus*). It is possible that the larvae in question in this case may have been derived from external sources, possibly the food.

Berlese (A.). **La distruzione della Mosca domestica.** [The destruction of the House-fly.]—"*Redia,*" viii, pt. 2, Feb. 1913, pp. 462-472, 4 figs.

The author during the months of July and September at S. Vincenzo (Pisa) found himself under the necessity of taking special measures to put down the house-fly. He had already noticed, as a result of some years' experience, that in those localities in which the olive trees were systematically sprayed against the olive fly, the house-fly had almost totally disappeared, to the great comfort of persons dwelling in the neighbourhood. He was further convinced of the impracticability and inefficacy of any attack upon the larval forms of the common fly and that the only effective method of putting down the pest was to attack the adult insect. Most of the flies emerge with immature eggs in their ovaries and it is only several days after emergence that reproduction can take place, so that if they can be killed within this period their increase is seriously interfered with. Flies do not stop in houses during the whole of the day, but a very large proportion of them go outside and live upon plants in the neighbourhood of the houses, for the most part attaching themselves to the undersides of leaves, of which the author figures several showing them to be spotted all over with fly excrement. If all manure and rubbish-heaps be carefully sprayed with a solution of arsenic in sugar and water the double advantage is obtained of the attraction of the flies to the spot and the certainty of their being poisoned, and further, as the flies breed in such heaps, the author argues that they are killed early in their existence and the deposit of any eggs by them is more or less completely prevented. He says that it is almost waste of time to kill flies in the interior of houses, because their place is immediately taken by others from the outside, that these external sources are almost inexhaustible, and that the practical difficulties of keeping flies out of houses by screens and nets are such that these methods are useless.

For two years at S. Vincenzo the author has been able to rid the neighbourhood of what used to be an intolerable pest by the following method:—He prepared a solution of 10 parts of treacle, 2 parts of arsenite of potash or soda and 100 parts of water, and with this solution all the plants in gardens, orchards, &c., round about habitations were diligently sprayed, the idea being to average two or three drops on each leaf. At the same time all heaps of manure and other likely breeding or feeding places were sprayed with the same mixture. The operation was performed every 10 days and renewed after a fall of rain. The manure-heaps and deposits of rubbish were sprayed whenever they had been moved and a fresh surface exposed. He caused a number of cylindrical metal dust-bins to be distributed about the village, so placed as to be out of the reach of children, and the surface of the contents of these were regularly sprayed, enormous numbers of flies being thus destroyed. In 1912 the author experimented with bunches of straw hung outside the houses under a zinc cover to protect them from the weather, the straw being dipped in the following mixture:—Honey, 1 part; treacle, 1 part; sodic arsenite, ½ part; water, 10 parts. By the use of 1 cwt. of treacle and a few kilograms of waste honey and the assistance of one labourer, the author succeeded in each of two years in almost totally destroying the flies in the village during the period of his residence. Three days after the commencement of operations the reduction was so great that instead of having his meals interrupted and even prevented by veritable clouds of flies they were reduced to two or three, and the same occurred in other houses in the village. It is suggested that if the method were systematised, it would be possible to adopt it as a thoroughly practical means of ridding even large places of the pest. Prof. Berlese further notes that when these methods are carefully applied in the neighbourhood of stables, the numbers of *Stomoxys calcitrans* were notably diminished.

YERBURY (Col. J. W.). *Haematopota italica*, **Mg., in Cornwall.** —*Ent. Monthly Mag.*, March 1913, p. 65.

Two female specimens were taken by the author in Sheviock Wood close to the tidal waters of the River Lynher in September 1912.

ROUBAUD (E.). **Études biologiques sur les Auchmeromyies.** [Bionomics of *Auchmeromyia*.]—*Bull. Soc. Path. Exot.*, vi, 1913, pp. 128-130.

Auchmeromyia luteola, F., and *Choeromyia*, of which the author has described two species from the Sudan, represent a small special group of CALLIPHORINAE characterised by the blood-sucking habits and intermittent parasitism of the larva. The adult *A. luteola* avoids the light, and this habit is still more pronounced in *Choeromyia*, because they live in the darker parts of the burrows of mammals. This habitat is more or less general in these species. In the Upper Gambia, the author has discovered *A.* (*Choeromyia*) *praegrandis*, Austen, living in the burrows of the antbear (*Orycteropus*), as does the *Choeromyia* of the Sudan. All *Auchmeromyia* are equally sensible to heat; they die rapidly in the sun or if exposed to a temperature of 45° C. in a closed chamber; in cages which are unequally heated they seek the coolest part. The adults of all *Auchmeromyia* are blood-feeders. They can be kept alive for a considerable time on a diet of sweet liquid, but this appears to render them incapable of oviposition. In captivity *A. luteola* was observed to have at least two definite periods of oviposition, separated by an interval of about a month. The author has obtained as many as 83 eggs from a single fly, the larger proportion of which were deposited on the first occasion. The larvae of *Auchmeromyia* are exclusively blood-feeders, taking no other nutriment, and their power of resisting starvation is very remarkable. From the moment of emergence from the egg they may be kept in absolutely dry surroundings without food for more than three weeks. Older larvae can easily resist starvation for a whole month, and the author says that he has kept a larva of *A. luteola* under these conditions for 66 days. If the larvae are fed daily their total life is from 14 to 15 days. They moult twice, once about the second and again about the sixth day. If the feeding is interrupted by long periods of starvation the development is much delayed. In the case of *A. luteola*, feeding once a week, or at intervals of 10 days, postponed the nymphal stage for 2½ months; a similar effect is produced on the period of moulting. If fed by day, and also after several days of starvation, the larvae lose their usual nocturnal habits.

When buried in the soil the larvae exhibit a curious sensibility to heat. If the surrounding medium be slightly warmed, the larvae wake up, become very active and seek the source of heat; this fact can be easily observed in a glass vessel. It is apparently by means of this thermotropism that the parasites, dispersed in the soil, are guided to their host. This sensibility to heat is only manifested by larvae without food; when fed they are apparently insensible to a rise in temperature.

NICOLLE (C. N.), BLAIZOT (L.) & CONSEIL (E.). **Etiologie de la Fièvre Récurrente, son mode de transmission par les poux.** [Etiology of Recurrent Fever and the mode of its transmission by Lice.]—*Ann. Inst. Pasteur*, 25th March 1913, pp. 204-225.

The researches recorded in this paper were undertaken by the authors during an epidemic which raged in Tunis and its neighbourhood from February to August, 1912. Recurrent fever is rare in Tunis; its very special characters do not permit the supposition that it has been overlooked. It was first recognised in the country by Lafforgue in 1903 amongst the natives of the district of Zaghouan; again by Conseil in the Mussulman hospital in Tunis in 1907; and a large number of cases were observed by Blaizot and Gobert at the phosphate mines of Redeyef in South Tunis, several cases from this source reaching Tunis itself. The disease has been known in Algeria at least since 1866. The various epidemics which have been observed in Tunis have all been traced to Tripoli and immigrants therefrom.

The disease has been known for a long time under the name of typhus, and the authors consider they are able to show a like origin for it and for exanthematous typhus. In the native tongue both appear to be confounded in the name "m'ard qmel" (the louse disease), which Cardaliaguet has proposed for exanthematous typhus. The mere spread of the term should, in itself, act as a prophylactic.

The authors discuss at some length early opinions on the etiology of recurrent fever and the attempts that have been made to incriminate bugs and fleas. They examine the evidence and endeavour to show that it is entirely unsatisfactory. Similarly other authorities have sought to fix the responsibility for the transmission of the infection upon the bite of the body louse, the evidence for which is examined and again the proofs declared unsatisfactory. The authors have no doubt that the spirilla are taken up by the louse, and that for a time they seem to disappear within their bodies, to reappear some days later and then to disappear again entirely. They say that the only reliable experiments as to the transmission of recurrent fever by infected lice have been made, not by allowing them to bite the infected man or monkey, but by the injection or subcutaneous inoculation of an extract of infected lice.

Despite the strong experimental evidence against the transmission of the disease by lice, the authors are still of opinion that in another way the louse plays a very important part, as shown by a case which occurred during the last epidemic in Tunis. A workman from Tripoli carried the infection to a "fondouk" in Tunis, of which two rooms were occupied by a colony of his compatriots. Very shortly afterwards every one of these was infected. There were no animals in the room whatever and the minute investigation of the furniture and other contents yielded two fleas, one bug (almost dried up), no specimens of *Argas* or biting ticks of any kind, and further, by reason of the time of year, no mosquitos or *Stomoxys*. On the other hand, body and head lice were found in enormous numbers.

The authors continuing their investigations during the time that the epidemic was spreading, recognised that this method of propagation was precisely that of exanthematous typhus, which in the preceding two years had claimed numerous victims in Tunis.

As has been already established in the case of the latter disease, there was no contagion in the wards where the sick were isolated and treated; the only cases occurring in the hospital itself were those among the staff of the receiving ward. As with exanthematous typhus, the sufferer from recurrent fever is no longer contagious when once his clothes have been removed and he has been washed, and thus the authors were gradually driven to the conviction that in spite of the failure of other observers to prove that the louse could carry infection by its bite, the louse, and the louse only, was the transmitting agent of recurrent fever. Starting with this conviction they repeated a large number of experiments of other observers and were able to prove to their own satisfaction that neither man nor monkey is capable of receiving the disease through the bites of lice which have been fed to the fullest possible extent upon the bodies of patients suffering from it. Some of the monkeys were bitten between two and three hundred times, under various suitable conditions, without result; five men were similarly experimented with, each of whom was bitten a very large number of times by infected lice under proper conditions, but without result. The authors thus found that their careful experiments were directly contrary to the conviction acquired from hospital and similar experiences. The next point investigated was the behaviour of the spirilla ingested by the lice. The general result of these observations, which appear to have been carried out with extreme care, was that the spirilla ingested at first disappear entirely, but reappear about the twelfth day as exceedingly minute and active organisms. A large number of observations are recorded, which had for their object the determination of the date of infectivity of the louse after feeding upon the patient and with the following general results; the reappearance of the spirilla in the body of the louse seems to occur between the eighth and the nineteenth day, after which they again disappear. The percentage of lice infected was found to be about 17½. They also found that four times as many female lice became infected as males, and this proportion applies equally to *P. vestimenti* and *P. capitis.* The authors were able to show that the spirilla are exclusively found in the general body cavity of the lice. Minute examination of the contents of the alimentary tract of infected lice failed to exhibit any spirilla; a similar examination of their excrement voided on the human skin gave the same negative result. It was observed that in thirty cases of dead infected lice, examined immediately after death, no spirilla were ever found. Reasoning from the fact that direct transmission of the disease by bite was hardly possible, they argued that in order to explain the relation between the louse and the transmission of the disease, some means must be found by which the contents of the body cavity of the infected insect can come into contact with a raw surface of the skin. Two experiments were made upon men; one by rubbing the extract of two pounded lice upon a slight excoriation of the skin, as a result of which the man contracted spirillosis. In the second case, the extract was dropped into the eye, and again the subject contracted spirillosis. In both cases the disease was cut short by the injection of salvarsan. The authors consider that in this way they have satisfactorily proved: (1) that the louse is the carrier of spirillosis; and (2) that the method of infection is not through the bite, but through the louse causing irritation to the individual who crushes it and at the same time breaks the surface of his skin with his nail and thus opens the way for the entry of the poison into his system.

Some further experiments made by the authors tend to show that the spirillosis is, so to speak, hereditary in the louse, that is, that the eggs laid by the infected louse will produce young containing spirilla and capable of transmitting the infection in the manner described. It seemed to the authors possible that as *Ornithodorus moubata* is undoubtedly known to be the carrier of another form of spirillosis, the South Tunisian *O. savignyi* might also transmit recurrent fever. Large numbers of these ticks were obtained and were allowed to bite three monkeys, but the results were entirely negative.

TAFOZOOL HOOSAIN. **Bed-bugs and their destruction.**—*Indian Med. Gazette*, Feb. 1913, p. 84.

In a letter to the *Indian Medical Gazette* the author says that medicinal turpentine is exceedingly effective in destroying bed-bugs, but that it should be made into an emulsion with its own volume of soap-suds. Without these it has not the proper effect, as the bugs having very smooth and hard backs turpentine alone runs off and the bugs get away and escape destruction. The soap-suds cause the turpentine to adhere to them in such a way that they can never escape alive.

Houston (Major W. M.). **Formalin against Flies.**—*Indian Med. Gazette*, Feb. 1913, p. 84.

The author says that he has found it useless to expose formalin in shallow plates for the purpose of killing flies, but that if a mixture of formalin, milk and water be sprinkled about a room in tiny pools of a ¼ inch to 1 inch in diameter the flies readily drink it. He has used this method in the jail kitchen at Rajkot with great success.

Franca (Carlos). ***Phlebotomus papatasii* (Scopoli) et fièvre à Pappataci au Portugal.** [*Phlebotomus papatasii* and Pappataci Fever in Portugal.]—*Bull. Soc. Path. Exot*, vi, 1913, pp. 123-4.

The author says that in 1911 he was asked by Dr. Arthur Neiva, of the Institute Oswaldo Cruz, whether the genus *Phlebotomus* existed in Portugal or not; he thought this probable since R. Blanchard had notified its existence in the south of France and in the Alpes-Maritimes. Certain specimens of *Phlebotomus* taken at Collares were sent by the author to Dr. Neiva, who identified them as *P. papatasii*. Franca says that in spite of much investigation it is only at Collares that he has been able to find the flies, and then only the adults, and during the months of August, September and October. A single case of pappataci fever having come under his notice, he asked his medical colleagues to make further enquiries, and they reported the existence of several cases of fever, the symptoms of which entirely agreed with that transmitted by *Phlebotomus*. He has been unable to induce the fever experimentally by reason of the small number of flies obtained.

Newstead (R.). ***Phlebotomus* from West Africa.**—*Bull. Soc. Path. Exot.*, vi, 1913, pp. 124-126.

In this paper the author describes a *Phlebotomus* captured in Mauritania by Dr. E. Roubaud. The specimen was somewhat damaged, and though greatly resembling *Phlebotomus duboscqi*, the author thinks that it may be a new species for which he proposes the specific name *Phlebotomus roubaudi*.

Roubaud (E.). **Quelques mots sur les Phlébotomes de l'Afrique occidentale française.** [Notes on *Phlebotomus* in French West Africa.]—*Bull. Soc. Path. Exot.*, vi, 1913, pp. 126-8.

The author says that *Phlebotomus roubaudi*, Newst., is very common at Boutilimit and Akjoucht in Mauritania, but in neither of these localities has pappataci fever been observed. *Phlebotomus papatasii* is very common at Timbuctu, and is known by the name of "banko." The larvae probably develop in the latrines and in earth which has recently been pugged for wall building. The adults are more often found in newly-constructed houses than in others, and they bite in the daytime during the siesta; but in spite of the abundance of *Phlebotomus* in the district the sanitary service has not reported any case of pappataci fever.

It is of interest to note that whilst *P. papatasii* is the prevailing species at Timbuctu, *P. duboscqi* is the species which predominates at Hombori within the bend of the Niger. The Dahomey species, *Phlebotomus* sp. n., was only observed on one occasion, and no other species has been found in Dahomey.

Phlebotomus minutus var. *africanus* has been observed at Bingerville under interesting conditions. A lizard (*Agama colonorum*) was found in the latrines asleep with its body covered by a cloud of female *Phlebotomus* gorged with blood. Large numbers of the flies were also gathered around the lizard and on the wall close by. The animal did not appear to be annoyed by the bites, nor did it seek to free itself from the flies. The chief interest of this fact is that it explains how *Phlebotomus* can feed itself under natural conditions. Generally speaking, these insects are not widely spread in Western Africa; at all events, their presence is hardly noticed, probably because they feed upon animals other than man.

Nicolle (C.), Blaizot (L.) & Conseil (E.). **Du rôle négatif des poux dans la transmission expérimentale de la fièvre des tiques.** [The negative *rôle* of lice in the experimental transmission of Tick Fever.]—*Bull. Soc. Path. Exot.*, vi, Feb. 1913, pp. 106-7.

The authors refer to their papers in the Comptes-Rendus de l'Academie des Sciences of the 10th June and 26th August, 1912, on the part played by lice in the transmission of the type of recurrent fever found in North Africa, and they were anxious to discover whether lice played an analogous part in the transmission of other forms of human spirillosis. As only the blood of man or of monkeys could be used for feeding the lice, it was necessary first to infect a monkey, and this was difficult, because the virus used had lost much of its force by having passed through several series of mice; however, they at last succeeded in infecting a monkey and feeding upon him a large number of human body lice. Under the microscope these showed abundance of spirilla which rapidly degenerated and in about two hours became invisible. Of the surviving lice 101 were fed for 15 consecutive days morning and evening, on the body of a man who volunteered for the experiment, and in the intervals were kept in a moist chamber at 27° C., which had been found to be suitable from previous experiments. On the eighth day four lice were examined under the microscope and showed no spirilla. A total of 59 lice, 22 males and 37 females, were examined up to the 15th day with absolutely negative results, and the authors regard the experiments as tending to show that lice play no part in the transmission of Tick Fever. They nevertheless are careful to observe that the virus used, although fatal to the monkey, had probably been greatly enfeebled by the transmission through mice.

GIEMSA (G.). **Das Mückenspray verfahren im Dienste der Bekämpfung der Malaria und anderer durch Stechmücken übertragbarer Krankheiten.** [Spraying as a means of preventing Malaria and other diseases carried by biting flies.]—*Arch. f. Schiffs- u. Trop. Hyg*, xvii, no. 6, March 1913, pp. 181-190.

The author points out that the present methods in use for the suppression of malaria and other insect-borne diseases are all directed to the prevention of the breeding of the disease-carrier and that little is done by way of attack on the insects themselves. Steudel (*Arch. f. Schiffs- u. Trop. Hyg.*, 1911, p. 121) called attention to this neglect of a very important means of preventing, or at least diminishing, the spread of malaria. Careful examination of numerous native huts at Garua (Kamerun) led to the discovery that large numbers of Anophelines passed the dry season in these huts in a state of torpor, and he argued that if these (a large majority of which are probably infected) could be destroyed, the number of infection carriers would be very sensibly diminished. The practical difficulty lies in the devising of the means for their destruction, as fumigation is not practicable, by reason of the construction of the huts. The author and Mühlens experimented in Hamburg in 1911 with sprays on mosquitos hibernating in cellars, etc., with very good results. In order to wet the insects effectively the fluid must be atomised; they regard the principle of the ordinary scent diffuser as not the best for the apparatus required, and a specially constructed nozzle is recommended for this purpose. The choice of the fluid insecticide to be used is somewhat limited in practice, inasmuch as human beings are concerned and the effect upon them has to be considered. Mixtures containing phenol and cresol, for example, were found, when diffused in this way, not only to leave a very persistent and penetrating odour, but to be intensely irritating to the human respiratory tract; the same objection was found to apply to solutions of quassiin. The author arrived at the following mixture as suitable for the purpose and free from these objections:—

	Grms.
Pyrethrum tincture (20 parts powdered Pyrethrum flowers to 100 parts 96 per cent. spirits of wine, to which $2\frac{1}{2}$ per cent. denatured methyl alcohol has been added) of this	580
Potash soap (as odourless as possible)	180
Glycerin	240

The above mixture to be diluted with 20 volumes of water before use. The apparatus used (3 forms are figured) should have a delivery tube of some length so that the operator shall not be involved in the spray. The nozzle is directed to be held at about half a metre (18″-20″) from the walls or objects to be sprayed. In the case of operations lasting some time or under conditions such that the operator can hardly avoid the spray himself, the use of a respirator is recommended. One hundred grammes of the fluid are said to suffice for 50 cubic metres

BECK (Dr.) & WECK (Dr.). **Die menschliche Trypanosomen-Krankheit am Rovuma in Deutsch-Ostafrika.** [Human trypanosomiasis on the Rovuma in German East Africa.]—*Arch. f. Schiffs- u. Trop. Hyg.*, xvii, no. 5, March 1913, pp. 145-160.

In July and August 1911 a number of cases of sudden death were notified to the authorities as occurring in the village of Jumben Mtira on the Sassawara, and blood-smears sent to the laboratory at Dar-es-Salaam showed two women to be suffering from trypanosomiasis. In consequence of this discovery the authors were instructed to make an inspection of the districts involved and 20 cases of trypanosomiasis were found. The organism is said by the authors to be so far different from *T. gambiense* as to merit distinction as a new species, which they propose to name *T. rovuma*.

The whole district along the banks of the Rovuma was examined for *Glossina*; *G. palpalis* was nowhere found, but *G. morsitans* was exceedingly numerous in many localities. The area of distribution of *G. morsitans* in the administrative district of Songea is described as extending along the whole of the Rovuma from the Sassawara westwards as far as the mountains flanking Lake Nyassa and northwards 2 or 3 days' march from the Rovuma, as far as the Matagoro hills, about 4 hours south of Songea. In the southern part of German Nyassa *G. morsitans* was occasionally found, and their presence there is regarded by the authors as more or less accidental. In the north-east corner of the district on the Ruhudje, *G. morsitans* was found in larger numbers and for about 3 hours' march from the junction of the Pitu with the Ruhudje. At Mitomoni, in March and April, about 1 per cent. of the *Glossina* were found to be infected; in August and September the figure rose to 4-7 per cent. A large percentage of the big game in the infected areas on the Rovuma and Ruhudje yielded trypanosomes; goats were found infected at Mitomoni, as well as the cattle of the Chief of Samtanga, 6 hours' march south of Songea, and those of the Chief of Sulinyonga at Kitanda.

The question of the part possibly played by other insects in spreading the infection is under investigation. *Ornithodorus moubata* is found all over the Songea district, with the exception of the neighbourhood of the Rovuma, but appears to have nothing to do with carrying the infection. A large number of these ticks were allowed to bite infected monkeys for 14 days, and 4 days after the last meal of blood neither trypanosomes nor anything resembling them could be found in their bodies; numbers of TABANIDAE and *Stomoxys* were examined with a like result.

The authors discuss the local difficulties in the way of preventing the spread of the disease. Removal of the natives from the banks of the Rovuma is hardly possible on account of the great breadth of the fly-belt on either bank, and any effective closing of the frontiers of the district is regarded as impossible, as nothing can be done to prevent infected persons passing into Portuguese territory. A case is quoted of a man and his wife who were both attacked by the disease in the village of Hiwindi in the south of Nyassa and who both migrated to Portuguese territory and died there.

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STRICKLAND (E. H.). **Further observations on the Parasites of** *Simulium* **Larvae.**—*Journal of Morphology*, xxiv, no. 1, 20th March 1913, pp. 43-94, 6 pls.

The author bases this paper upon observations of parasites of *Simulium* larvae made during the autumn of 1911 in the neighbourhood of Boston, U.S.A. The streams there were found to contain immense numbers of these larvae, the most abundant species being *S. hirtipes*, which occurred in such vast masses that in certain streams hardly a stone could be found which did not support one or more colonies. Large numbers of the larvae of this, and those of an undescribed species were parasitised by Microsporidians. By the middle of May all the larvae of the generation under observation had pupated and hatched and during the summer few were to be seen in any of the streams; only here and there did the author find an isolated specimen of the larva of *S. bracteatum*, Coq. Early in October the search was resumed and the larvae of *S. bracteatum* were found everywhere, though always living a solitary life; of *S. vittatum* a few specimens occurred in one stream, *S. hirtipes* not being found until the beginning of November, after which it was common in some localities. By the middle of November it was difficult to collect larvae because the streams were filled with fallen leaves to which the larvae attach themselves in preference to stones.

The author describes and figures the larva and pupa of *S. bracteatum* and discusses certain structural peculiarities and habits of *Simulium* larvae which bear on the subject of parasitism. These larvae are particularly difficult to study in the living condition because they cannot be kept alive for a sufficient time in captivity, one of the principal reasons being that their respiratory gills are very small and they are unable to obtain the oxygen they require in sufficient quantity from stagnant water; in nature they live only in very rapidly flowing water. It is further a matter of interest that the majority of the pupae of *Simulium* fail to hatch in captivity, probably owing to insufficiency of oxygen.

The classification, typical life-cycle and general host relationships of the *Microsporidia* are given, with a list of insects infested by them. Several species of *Microsporidia* are described at length. The probable mode of entry into the body of the host is discussed and also the effect of the parasite upon the hosts, the most remarkable of which appears to be the destruction of the reproductive organs. These are easily found in sections of healthy larvae, but the author says that in parasitised larvae he was quite unable to find them. He is convinced that parasitised larvae never reach the adult stage. He summarises his results as follows:—That in the neighbourhood of Boston there are three distinct classes of parasites infecting and in each case killing *Simulium* species in their larval stages: (1) Parasites of the spring brood of *Simulium*, of which various *Myxosporidia* caused a mortality of 80 per cent.; (2) a species of *Mermis*, affecting 25 per cent., and (3) parasites of the autumn brood, viz., 3 species of *Glugea*, one rare and the others causing from 5 to 10 per cent. mortality, and a species of *Gregarina* causing up to 50 per cent. mortality. He also says that from no other locality in North America have these or similar parasites been recorded.

Considering the enormous amount of damage done to cattle in districts in which *Simulium* is abundant, the importance of the parasite in keeping them down is obvious, and inasmuch as the localities in which the latest observations were made are relatively free from the pest, although the larvae are to be found in enormous numbers, the author concludes that it is the parasites which keep them in check. His observations lead him to the belief that there is a seasonal variation of parasitism, as the species of parasite found in the spring were not taken again in the autumn and *vice versâ*, so that it is probable that only those species of *Simulium* whose life-history coincides with parasitised species could be infected with the parasites of the latter. He is also strongly of opinion that infection is only possible during the early stages of larval life and that it will probably be necessary to collect the parasitised species and place them in streams where the other species is always abundant, some little time before the eggs of the latter hatch. He thinks that the gregarine parasite should be carefully studied, although he was able to find it only in one species of *Simulium*. He regards the whole question of the existence of these parasites and the possibility of their use in the suppression of a serious pest, as one of great importance in economic entomology, and suggests that every effort should be made to experiment upon the feasibility of transporting the parasites to those districts in which the pest is serious. A bibliography concludes the article.

Smith (F.). **Dengue Fever among the Troops in Calcutta; its identity with Seven-day Fever and Three-day Fever.**—*Jl. R.A.M.C., London*, xx, no. 4, 13th April 1913, pp. 453-458.

Year after year the troops in Calcutta are attacked by a short fever which produces much inefficiency but no mortality. In 1912 the author had an opportunity of dealing with the disease and has experienced an attack in his own person. He has little doubt that the outbreak of 1912 was similar in character to that of 1911, and he is sure that the fever of 1912 was dengue, but the same fever has previously been called seven-day fever and three-day fever. It always comes on in hot weather. Up to 27th October 1912, no less than 461 cases of European soldiers were treated and 2 native regiments suffered severely. Officers, men, and women suffered alike. The pain was considerable, but the secondary rash was not so universal as it should be according to Manson and Daniels. The author says that it may be objected that the shorter fevers were really sand-fly fever, but he urges that in both the short and long fevers the symptoms were so much alike and occurring at the same season that he is convinced that they are one and the same disease. He thinks it worthy of note that a regiment of Pathans, who come from the sand-fly fever part of India, were much more heavily infected than the South Indian Regiment, from which it seems probable that sand-fly fever confers no immunity against Calcutta fever, and the truth may be that the two diseases occurred at the same time and place, and that clinical observation alone is not sufficient to distinguish 3-day dengue from 3-day sand-fly fever. The author says that the commonest biting insects during the period of greatest prevalence of the disease were *Anopheles rossi*, *Culex impellens*, *C. fatigans*, *Stegomyia scutellaris* and *S. fasciata*. Other mosquitos found were *Stegomyia (Desvoidea) obturbans*, *Culex concolor*, *Toxorhynchites immisericors*, *Culex (Leucomyia) gelidus*, *Culex microannulatus*, *Mansonioides annulifera*, and *Mucidus scatophagoides*.

A few sand-flies were taken, but these insects were not very numerous or troublesome in malarial areas in Calcutta. No *Phlebotomus papatasii* were found; only *P. minutus* and *P. argentipes*. Biting Chironomids which fed on man were also met with and were not uncommon during the period when dengue was most prevalent. These insects can pass through an ordinary mosquito net, as indeed can some mosquitos, for example, *Stegomyia scutellaris*. The disease met with in Calcutta is extraordinarily local in prevalence. Stations within 10 miles or so of the city are said to be almost entirely free.

Beach (Lt.-Col. T. B.) & Leeson (Capt. H. H.). **An outbreak of Malaria in "F" Company, 2nd Devon Regiment.**—*Jl. R.A.M.C.*, *London*, xx. no. 4, 13th April 1913, pp. 450-452.

The interest of this paper lies in the fact that it establishes beyond doubt the period of incubation of the aestivo-autumnal type of fever under the given conditions. On the march from Troodos to Limasol, in Cyprus, the company bivouacked at a place called Zeegoe on the night of October 1st. On 27th and 29th September, before leaving Troodos, every man received 10 grains of quinine. The place of bivouac was greatly infested with mosquitos and most of the men complained that they were severely bitten that night. The next day they reached Limasol and embarked for Alexandria. During the stay of the company in Cyprus only one man contracted malaria. For 11 days after arrival in Alexandria the health of the company was good, but from October 13th cases of fever began to occur and by the 17th 17 cases had been admitted to hospital.

There can be little doubt that the disease was contracted on the evening and night of October 1st, and this is interesting as showing very definitely the period of incubation. There was evidence of previous infection (malarial pigment, etc.) in one case only, that of the single soldier who contracted fever at Troodos.

Cragg (Capt. F. W.). **Studies on the Mouth Parts and Sucking Apparatus in the Blood-Sucking Diptera. No. 1.**—*Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India*, no. 54, 1912, 17 pp., 5 pls.

The species dealt with is *Philaematomyia insignis*, Aust., which occurs throughout the Oriental Region and also in Tropical Africa. So far as is known, it preys exclusively on cattle, being much the commonest blood-sucking fly at Guindy, Madras. The species is stated to breed in dung.

Cragg (Capt. E. W.). **The Structure of** *Haematopota pluvialis*, **Meigen.**—*Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India*, no. 55, 1912, 36 pp., 7 pls.

This memoir contains an exhaustive description of the external and internal anatomy of this common Palaearctic *Haematopota*, and also an account of the method and mechanism of feeding. It is suggested that the transference of the normal parasites of the fly from one individual to another may result from the continual defaecation by the insects upon the skin of the host.

Disinfection of Poultry Houses and Runs.—*Jl. Bd. Agric., London*, xx, no. 1, April 1913, pp. 39-41.

Experiments have been carried out by Mr. H. H. Aitken on this subject on several farms where poultry were kept under average fair conditions, but where the birds were, nevertheless, troubled more or less during the whole year with fleas, lice and mites. The method adopted to get rid of these pests was as follows:—Solutions of commercial disinfectants, made up to double the strength recommended for ordinary domestic use, were applied by means of a watering-can, fitted with a fine rose, to the inside of the house, the wood-work and the soil of the runs, and to the dust-bath. This operation was performed weekly; no improvement was noticed in the condition of the birds at first, but after a period varying from six weeks to two months from the time of the first application, examination of the birds showed that the parasites were greatly reduced in numbers and that they gradually disappeared. The stock became healthier, and the egg production, as compared with that of previous years, showed an average increase of 15 per cent. In one case a cottager, who kept records, stated that an expenditure of 2*s*. on disinfectants had increased his receipts from the eggs from 20*s*. to 24*s*. in the year. In one case the process was used at a farm where gapes had caused great trouble in the spring of every year, and last year (1912) the chickens were practically free from it.

Weekly disinfection is found to be necessary at first, but once the birds are healthy and the runs and houses clean, the interval may be considerably increased. The frequency of the application should, to some extent, be determined by the climate and the season of the year. A knapsack sprayer or a garden syringe serve the purpose better than a watering-can.

STOCKMAN (Sir S.) & BERRY (A. H.). **The** ***Psoroptes communis ovis;*** **some observations on Ova and Ovipositing.**—*Jl. Comp. Path. & Therap.*, xxvi, pt. 1, March 1913, pp. 45-50.

This article is the continuation of work previously recorded in the annual report of the Chief Veterinary Officer, Board of Agriculture and Fisheries, 1911, and Jl. Comp. Path. and Therap., 1910. One of the chief points investigated was the number of eggs laid by each female, the authors having found that the female is usually oviparous, though on two occasions specimens were found which contained eggs including apparently fully developed larvae. If females are taken from a sheep, placed in a glass dish or tube and incubated, a considerable proportion of them will lay, but it was found to be exceptional for the female to lay more than one egg after being removed from its host, unless it were returned to the sheep for further feeding. On only one occasion did the specimen lay two eggs. The ova require an average of 100 hours for hatching, in a slightly moist atmosphere. Some do not hatch until the sixth or even the seventh day. While the authors confirm the observation of Gerlach that the average number of eggs laid is about fifteen, they are nevertheless of opinion, as the result of numerous observations, that this number may be considerably exceeded, in some cases rising to even more than thirty. The process of oviposition is slow; two eggs in twenty hours, or three in twenty-four, seems to be about the average rate, and the whole period of oviposition lasted about eight days, after which the females appeared to die. The period required by the acarus to pass through all its stages is about twelve days. In some cases the females, for some unknown reason, decline to produce eggs for a considerable time after being put on the sheep. The authors are of opinion that an outbreak of sheep scab may be started by one fecundated ovigerous female, and they also think that their observations provide a further explanation of the long intervals which frequently elapse in practice between contact with infection and the appearance of the visible scab.

Observations have shown that living larvae are seldom found on sheep after dipping, and they were subsequently able to show that after dipping scabby sheep in arsenical dips a few larvae may hatch out, but that these usually leave the dipped sheep. This was found not to be the case with dips of the creosote type, and it was therefore considered advisable to make experiments in vitro, with the following results:—

Two lots of eggs, numbering 60 and 30 respectively, were immersed in an arsenical dip for one minute and then incubated;

several larvae hatched out in each case. Two other lots of 100 and 80 eggs respectively were similarly immersed for one minute in a creosote dip; no larvae hatched out. Finally, 300 eggs were immersed in creosote dip for half a minute, and the following day one larva had partly emerged and was not quite dead. Subsequent examination showed no signs of hatching or movement.

THEILER (Dr. A.). **Inquiry into Dips and Dipping in Natal**—*Agric. Jl. Union of South Africa*, v, no. 1, Jan. 1913, pp. 51-67, and no. 2, Feb. 1913, pp. 249-263.

In the first article the author gives full details as to the preparation of dips and the construction of dipping tanks. Scale drawings are given, with practical advice as to the dipping of various animals, especially cows in calf and horses. One report with regard to the dipping of foals said that the result of dipping every 3 days was "simply marvellous," the farmer in question remarking that in the non-dipping days his foals were all stunted in growth. The question of cost is also considered.

In the second article the effect of dips upon animals is dealt with, and statistics of accidents and other practical details are given. The author then discusses the question of the extent of tick infestation and says that the area of the farms involved in answers to questions sent out by the Department was 1,144 square miles, roughly one-eighteenth of the area of Natal. They represent various altitudes and conditions of soil and climate, and the returns show that the prevalence of ticks is not affected by mere elevation. Even at altitudes of 5,000 to 7,000 feet the tick infestation was stated to be gross, and on the coastal belt some farmers state that there are very few ticks present. The relationship, if any, appears to be rather to the number of cattle on a farm: the larger the herds, the greater the number of ticks. In some instances the absence of ticks is put down to the presence of the red-beaked tick bird. Farms in the middle veld were stated to be badly infested in most instances, and only moderately in others. In some parts of the low veld, ticks were so numerous that deaths of cattle were attributed directly to this cause. Out of 287 farms infested, only 9 were not fenced, but the author says that the evidence of the value of fencing as a barrier to the spread of East Coast Fever is more or less negative. The collection of ticks by means of grazing cattle is not attempted in Natal to any great extent, and it appears that such a procedure is not necessary.

Some farmers have adopted the plan of keeping cattle away from infected pastures for 18 months and so starving out the ticks. As a result of observations, it would seem to be necessary in Natal to dip cattle frequently in order to keep down East Coast Fever, and the author considers that experience again shows that short interval dipping (twice a week or sometimes oftener, and certainly at no longer intervals than 5 days) is necessary for the prevention of this disease in districts where it is very prevalent. A recurrence of the disease has been traced to the stoppage of dipping at short intervals. Striking results are reported where short interval dipping has been carried out in infected areas, surrounded on all sides by farms which have been infected for some years. Farms adjoining native locations, where practically all beasts had died out, never had any outbreaks, although cattle were dying along the dividing fence. Confidence in the value of the dipping tank is rapidly spreading and the author has no doubt that systematic short interval dipping can effectually check and finally eradicate East Coast Fever.

The effect of dipping on the ticks, as reported by the farmers, varies, some saying that a few days after starting the short interval dipping a decrease is noticed in the number of ticks on the dipped animals, and others reporting that the decrease only became evident after a number of dippings or only after several months. A reduction to a minimum only occurred after periods varying up to 1 or even 2 years. The decrease was stated to be most marked on the dewlap and udder, and between the hind legs, whereas the ticks persisted longer on the eyelids, in the ears and under the tail. The first species to be eradicated as a result of dipping is the so-called "blue tick"* (*Boophilus decoloratus*), which disappears after a few months. These ticks pass their cycle from larva to adult on one and the same host and live in the larval stage on grass for about 7 months, so that within that time, provided all are reached by the dip, they must completely disappear. The next said to disappear is the "bont or tortoiseshell tick," which is however not found in all parts of Natal, but usually on the low veld and on some farms in the middle veld. Some farmers say that this is one of the hardest ticks to kill and only disappears very long after dipping has been adopted. This statement can be understood, because this species, *Amblyomma hebraeum*, requires long periods between its moulting processes, so that stragglers may be caught only at a very late period, long after dipping started. The disappearance of the brown ticks (East Coast Fever ticks) is stated to take some time, and though they are but rarely met with on the body they seem to persist on various parts of the head. The life-history of these ticks explains the failure of long interval dipping to check them. In summer they can live in the grass for over a year, so that even dipping at intervals of 5 days allows a certain number of larvae and nymphs to escape, only to be caught again in their adult stage, when they remain on the beast for a longer time. The last tick to disappear, and all the farmers agree on this point, is the red-legged tick (*Rhipicephalus evertsi*), which attaches itself in a well protected region under the tail. This is however not the only reason for its longevity, for in the nymphal stage it lives deep in the meatus of the ear and probably no liquid reaches it, nor will hand-dressing suffice to destroy it. This tick attaches itself chiefly to horses, sheep and goats.

As to the possibility of stamping out ticks on a farm, evidence shows that even after years of dipping ticks will be found, but speaking from a practical point of view, they are so rare that they have to be searched for. One farmer states that there are now hardly 1 per cent. of the ticks as compared with 5 years ago; others say that ticks only disappear after 2 years of constant dipping and that the tortoiseshell and brown ticks are still present after 3 years. The long persistence of the "striped-leg tick" (*Hyalomma aegyptium*) is possibly due to the fact that the intermediate stages live on birds.

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* [This popular name is a very unfortunate one, not only because it is misleading in itself, but also because the term is so generally applied by farmers to the inflated females of any species of tick, on account of their bluish grey colouring.—Ed.]

The ticks which live on domesticated stock are also found on game and certain classes of other wild animals. The brown tick for instance is very common on hares and antelopes. The larvae and nymphs of the "bont-legged tick" are sometimes found on game, and thus the presence of birds and game tends to maintain the ticks. It is stated by the farmers that formerly duikers were smothered with ticks and that now none can be found on them. Similar statements are made concerning reedbuck, vaal rhebuck, haartebeeste, oribi, wild cat and hares. Some farmers, however, reported that there are just as many ticks on these animals as ever. Nearly all statements concerning ticks on the bushbuck indicate that the dipping of cattle has in no way affected these animals, and it is pointed out that the cattle do not go into the bush where these buck live and accordingly the ticks are not destroyed. Similar reasons may account for the farms where the duikers, reedbuck and hares were still infested.

Incidentally, dipping has greatly reduced a number of other troubles by removing the cause of irritation. Hair-balls have almost disappeared in calves, as the animals no longer feel under the necessity of licking themselves; but one of the most unexpected results is the practically complete disappearance of white scour in calves. The author says that the statements to this effect are almost unanimous. One farmer records that before dipping he lost half his calves from this disorder, and since dipping he has lost only 6 out of 180. Previous to dipping it was said to be almost impossible to rear calves when their mothers were milked twice daily. Navel ill is also reported to have disappeared. Red-water is said by some farmers to have become a thing of the past, and instances are quoted where cattle were safely introduced on to farms where previously 50 per cent. and more died. One farmer stated that Cape cows used to die in a fortnight after arrival; but he bought 40 between January and October last, and has now lost only 2. One particular instance is specially illustrative. A farmer re-stocked his farm with cattle from the upper districts. The dip was flooded out last October and owing to damage to the railway he could not procure arsenite of soda, so that for three weeks his cattle were not dipped. He lost about a dozen out of 30 head from red-water, but as soon as he recommenced dipping, red-water disappeared, and on many of the farms thoroughbred bulls have now been imported and no case of red water has occurred. The statements as to gall sickness are not quite so uniform, though it appears to have diminished. Other farmers report excellent results from dipping their horses and dogs. Biliary fever has become rare and it is possible to rear puppies. The fly nuisance in homesteads and kraals is said to abate as a result of dipping.

The article concludes with quotations from letters from various farmers, all of whom strongly advocate systematic and frequent dipping as the result of practical experience of its value.

HERRICK (G. W.). **Some External Insect Parasites of Domestic Fowls.**—*Journal of Economic Entomology*, vi, no. 1. Feb. 1913, pp. 81-84.

According to the different authorities on Mallophaga there are at least 8 species infesting the domestic fowl, 4 or 5 the goose, 3 or 4 the turkey, 4 the duck, 4 the pea fowl, 3 the guinea-fowl, and 7 the pigeon. In addition to the Mallophaga there are in America at least eighteen species of mites parasitic on the domestic fowl, two species of fleas, one fowl bug, one tick, and possibly one fly.

Both by their movements and by constantly biting the skin the lice cause serious irritation that eventually weakens the host and gives a chance for various maladies to get a hold upon it. This is especially true of chicks, whose growth is greatly checked if the lice are abundant; diarrhoea follows and a general weakened condition may result.

In addition to the Mallophagan parasites the fowl flea (*Ceratophyllus gallinae*) has been found in America. In the spring of 1912 specimens were received from Abington, Mass. They were taken from the inside walls of a poultry house and not collected directly from the fowls; probably the fleas had been imported from California.

ENSLIN (B. S. L.). **Scab in Sheep and Goats. Dipping and Dipping Materials.**—*Agric. Jl. Union of South Africa*, v, no. 3, March 1913, pp. 392-399.

The author points out that many farmers who have had no scab amongst their flocks for years are difficult to convince of the necessity of continued dipping and object to the expense of constructing tanks. They fail to recognise that dipping is not only a remedy for scab, but also keeps down lice and ticks which do serious damage. He insists that the farmer should realise that by dipping is meant the total submersion of each animal and its retention in the fluid for a period of two minutes during each of the two dippings required by law, and that the hand dipping in which so many farmers persist cannot be regarded as sufficient. He quotes Bulletin No. 7, 1912, of the Department of Agriculture, which contains full directions for the construction of tanks and the dipping of the sheep. A circular tank is recommended because (*a*) it is cheaper, (*b*) there is a greater economy of dipping material, and (*c*) it gives better results with less labour. The sheep can be kept swimming during the whole period of immersion, and when swimming the fleece is opened and the dip has a better chance of penetrating to the skin. The long narrow tank usually found in South Africa is not effective, because the sheep will take only from half a minute to one minute to swim through and has to be pushed or held back in order to keep it immersed for the required time, and this involves labour.

With regard to dipping materials the author strongly recommends a home-made dip, and gives directions for preparing three sulphur dips which have been found effective:—(*a*) sulphur and lime, (*b*) sulphur loogas (crude alkali), and (*c*) caustic soda and sulphur. The method of dipping is described, and the author points out that it is a well known fact that animals are often in the first stage of infection without showing visible signs of the disease. *Psoroptes communis* var. *ovis*, the sheep scab parasite, is frequently found on the goat, although it does not thrive on that animal, and one undipped animal can easily re-infect a whole flock in a very short time.

Detailed directions are given for the treatment of infected goats suffering from the *Sarcoptes* mite (commonly called the "Boer goat scab") which burrows under the epidermis. For this purpose it is most important that the dipping mixture should be of the exact strength and that it should always be used warm. All visibly infected animals should be marked and the affected parts specially scrubbed with some of the mixture from the tank, so as to soften the crust before the animal is dipped. Goats should be kept in the tank at least three minutes, and the day after dipping all the marked animals should have the infected spots rubbed with pure lard oil, and if affected about the head the oil should be thoroughly rubbed over the whole face, lips, ears, jaws and under the gullet; six days afterwards these animals should be examined again and if necessary again treated with oil. All goats in the flock should be again dipped and oiled within 10 to 14 days of the first dipping. Between the first and second dips the goats must be placed in a new kraal or sleeping place. Kids should be dipped before the full-grown animals are treated, and care must be taken that none of the mixture enters the mouth.

The author points out that the experiments of Mr. Davison at the Cape have conclusively proved that an infested kraal may still disseminate scab after a period of three years, and it is therefore very essential that all kraals and sleeping places should be thoroughly cleansed at the same time as the sheep are being dipped. The best means of effecting this is undoubtedly by fire, but if this is impossible, disinfection by spraying with a 5 per cent. solution of carbolic acid and subsequent lime-washing, will be permitted. Great care should be taken to remove all dung, and in those cases in which the walls of the kraals are made of dung cakes these should be burnt, or if the dung is intended to be used for household purposes it should be stored in some shed or enclosure to which stock cannot obtain access. Lastly the author points out that a farmer should take the precaution of preventing all sheep coming from other farms being mixed with his own before they have been dipped. Such sheep and the farm from which they come may have been clean for years, but there is always danger of picking up infection on the road.

HOOLE (E. T.). *Ceylon Administration Reports—Veterinary*, 1911-12, 4 pp.

In December 1911 a suspected case of surra occurred at Hatton: a horse was destroyed and strict measures taken to cleanse the stables and sheds and to abate the fly pest then prevailing. Altogether up to the end of April 1912, 19 cattle and 2 horses were destroyed as being suspected of surra. The disease is carried by a species of *Stomoxys* which swarms in the district to such an extent that in daylight a horse could not stand still for a minute out of doors. Strict sanitary measures have considerably lessened their numbers by destroying their breeding places. The annual loss from this cause in India, Africa and South America is very serious. Mauritius became infected about the time of the South African War to such an extent as seriously to interfere with transport and almost to prevent the planting and gathering of crops.

SWELLENGREBEL (N. H.). **Mededeeling omtrent Onderzoekingen over de Biologie van Ratten en Vlooien en over andere Onderwerpen, die Betrekking hebben op de Epidemiologie der Pest op Oost-Java.** [Record of observations on the Bionomics of Fleas and Rats and other subjects, bearing on the Epidemiology of Plague in Eastern Java.]—*Mededeelingen van den Burgerlijken Geneeskundigen Dienst in Nederlandsch-Indie*, ii, pt. 1, 1913, 90 pp., 7 maps, 13 charts, 1 plate.

Experiments on the transmission of plague by blood-sucking insects.—Laboratory experiments with fleas showed that when the number allowed to bite an infected animal was from 100 to 150 the infective stage did not last more than 15 days, but if 700 or 800 laboratory-bred fleas were used the infective stage continued for 21 to 28 days. The general result of the author's experiments in this direction was to show that *X. cheopis* is quite as well able to transmit plague in Java as in British India, and that in Java the flea remains infective for a somewhat longer time. The author thinks it worth recording that in certain experiments where plague-infected and healthy animals were put together without fleas, no transmission of plague ever occurred unless the infected animals were eaten. The mortality amongst the fleas used was very considerable, largely owing to the fact that they were infested by mites, which killed a great number by attaching themselves not only to the body and legs but even to the head and proboscis of the flea, thus preventing it from biting.

The experiments indicate the existence of an appreciable degree of immunity from plague in rats, which appears to vary locally.

Mr. Otten working at Malang succeeded in transmitting plague to rats by means of *Pygiopsylla ahalae*, but not to guinea-pigs. *P. ahalae* it appears does not readily bite animals other than rats. The insect was infective 10 days after sucking infected blood and plague bacilli were found in the midgut 14 days afterwards.

The Indian Plague Commission came to the conclusion that the plague bacilli reached the blood of the host through the faeces of the flea soiling the wound. The author thinks that this may be quite true of *Ctenocephalus canis* because the faeces of this flea are very liquid and are ejected during the act of sucking blood, but both he and Mr. Otten have observed that *X. cheopis* and *P. ahalae,* at all events in Java, act very differently; as also *Ceratophyllus fasciatus,* the faeces of which are hard and are obviously detached from the body with some difficulty. Occasionally the fleas become attached by their faeces and die in consequence. For these reasons the author thinks that the chance of the wound being infected in this way is not great.

In an experiment in which infection of the wound by faeces was absolutely excluded, all the guinea-pigs and 4 out of 5 rats became infected and died of plague. A number of investigations were made on the position of the plague bacilli in the gut of the flea, and the midgut was found to contain rather more than the rectum.

The author next investigated the infectivity of other human parasites, *Pediculus hominis* and *Cimex rotundatus,* in 11 different cases. Seven out of nine inoculations of guinea-pigs by the former caused plague, but those with *C. rotundatus* did not, possibly from want of sufficient material. The smallest number of lice which produced plague was 13, and the author was quite satisfied that *P. hominis* harbours plague bacilli and is capable of transmitting the disease from man to man.

Flea Census.—This was carried out over the province of Malang and its districts by Dr. Van Loghem by catching large numbers of field rats and counting the fleas on them. It was found that these carried a much smaller number of fleas than house rats, and it was further discovered that the number of fleas per house rat varies greatly in different districts. In two districts, Ngantang and Pakis, the number rarely exceeded one, whereas in Karangloo and Senggoeroeg it was more than 3 and often more than 4. By means of a map of the district of Malang showing the distribution of fleas from January to July 1912 and also the distribution of human or rat plague, it is clearly proved that a large flea census generally coincides with plague, but there are certain exceptions which are very difficult to explain. The investigators think that the increase of the number of fleas per rat shortly before an outbreak of plague might be the consequence and not the cause of rat plague, the latter causing a concentration of the fleas by the death of many rats. This agrees with observations in India. This question of the flea census is discussed at great length and with minute detail.

The bionomics of X. cheopis.—The author determined that this flea's life-history covered 31 to 52 days. He discovered that excessive moisture, amounting to saturation of the atmosphere, under the given temperature conditions, was fatal to the larvae and he thinks that this may account for the small number of fleas found on field rats living in holes in the rice-fields.

A number of experiments were made to determine how far fleas might travel from an animal, and it was concluded that *X. cheopis* does not travel far, 5 metres being regarded as a maximum. Amongst the enemies of fleas, ants were found to be very active and the author lost whole broods of larvae from this cause. He also found that large numbers of fleas are attacked by minute mites which he describes and figures. He says that the mite appears to represent the immature stage of some Tyroglyphid and closely resembles the genus *Anoetus*, Duj. These mites caused serious mortality amongst the author's bred fleas and were discovered to have arisen in the bran used to cover the bottoms of the glass jars. In experiments made at another place where sand was used, mites were not found on the fleas.

Experiments with fumigants for the destruction of fleas led the author to the conclusion that the killing of rats and fleas may be best effected by the use of sulphur dioxide and small articles may be best disinfected by carbon bisulphide.

Bionomics of the rats.—Elaborate observations were carried out to determine the distribution of the three species of rats. The small rat (*Mus concolor*) was found to be particularly troublesome in the houses, from its ability to enter relatively small holes in the bamboo used in their construction. Further observations were made in order to determine the distance to which *M. rattus* would travel and it was satisfactorily shown that house rats may be found as much as 650 yards away from the nearest village, even where there is no path of any kind. The author is satisfied that the travelling habits of this rat are much greater than is generally supposed, and this has an important bearing upon the spread of plague. The prevalence of trypanosome-carrying house rats and field rats in the province of Malang was investigated and found to be at a maximum of 37 per cent. in March, to diminish to 22 per cent. in July, and to increase again to 36 per cent. in November; the presence of trypanosomes is regarded as evidence of the transmission of infection from rat to rat by fleas, and this was found to be less among field rats than house rats. Similarly the distribution of *Mus decumanus* was carefully investigated, and it was found to be confined to isolated colonies. The percentage of trypanosome-carriers in this species was small, always smaller than that of the house rat, but greater than that of the field rat, and the author is of opinion that *Mus decumanus* in Eastern Java does not play such an important part in the epidemiology of plague as in British India.

Spread of Plague.—It has been shown by the author that lice from plague-infected houses are sometimes infective, but this is of little importance, because infected lice cannot cause rat plague and but few cases of human plague. It remained to be investigated to what extent rat fleas were found on natives in Java. From February 1912 the clothes and baggage of travellers leaving the province of Malang were disinfected with carbon bisulphide, the dead parasites being collected on a white sheet and subsequently identified. Between 14th February and 15th May 1912, 56,790 persons were examined and on them were found *Xenopsylla cheopis* (2), *Pulex irritans* (207), *Pygiopsylla ahalae* (1), *Ctenocephalus canis* (9), *Pediculus hominis* (1916), *Cimex rotundatus* (707), *Acarina* (6) and *Reduviidae* (1); that is to say, only 3 rat fleas were found on this large number of persons. It must of course be understood that they did not all come from plague-infected villages. A similar method was adopted by the doctors in attendance on plague patients throughout the province. The clothing of 1,829 persons (of whom 393 were plague-infected) was examined between 9th March and 30th November and there were found *Pediculus hominis* and *P. capitis* (7,641), *Acarina* (1), *Cimex rotundatus* (72), *Pulex irritans* (30) and *Xenopsylla cheopis* (7). No fleas were found if the inhabitants of plague-infected houses had changed their clothes, and although they afford some opportunity for the transmission of rat fleas, the ordinary measures taken, that is to say, disinfection and isolation reduced this chance almost to nothing. The result of these investigations at the disinfecting station in Malang shows, in the author's opinion, that human intercourse can hardly be of any importance in the spread of plague in Java. The dwellers in hotels, military hospitals and private houses were frequently observed to be troubled by fleas to such an extent as to cause great discomfort. A number of fleas were captured under these conditions and they were found to belong to the species *Ctenocephalus felis* or *canis*, and the author says that it is not at all uncommon in Malang to catch 18 or 20 fleas on one cat. This species of flea is never found on rats from Eastern Java and it was never observed that cats or dogs were attacked by plague. The general conclusion arrived at from these observations are that the spread of rat plague is mainly due to the house rats being able to get about the country in various ways, the ordinary traffic affording additional facilities. That traffic has a considerable influence in the spread of plague the author thinks is clear from the fact that the first villages to be attacked were those on the main roads.

Influence of climate.—A large number of observations were made upon climatic conditions in relation to the spread of the disease. The results were in the main negative but there was some evidence that plague spread slowly in low and hot districts if no quick means of transport was available, possibly due to the fact that fasting fleas are shorter lived in hot than in cold districts.

The author summarises his results as follows:—It would appear that the rat flea transmits plague in Eastern Java. Plague immunity among rats is not well developed in that area; more so at Sourabaya than at Malang. Plague epidemic is not confined to a certain season, but if the disease already exists the cases tend to increase with a rise in humidity. Heat and dryness of the atmosphere seem to prevent, to a certain extent, the spread of plague. The spread of the disease by the field rat and by *Mus decumanus* is of small consequence compared with that effected by *M. rattus*. Human intercourse does not appear to favour the spread of plague, though infection by lice may possibly occur. Rat plague may exist for months without human plague developing, and if cases of human plague should occur it is not always correct to ascribe them to importation. There appears to be a certain relation between the number of fleas per rat and the occurrence of rat plague and consequently the rat flea census is important as a warning.

Rodhain (Dr. J.) & Bequaert (Dr. J.). **Nouvelles observations sur *Auchmeromyia luteola*, Fabr., et *Cordylobia anthropophaga*, Grünb.** [Recent observations on *Auchmeromyia luteola*, Fabr., and *Cordylobia anthropophaga*, Grünb.]—*Revue Zoologique Africaine*, ii, pt. 2, 15th Feb. 1913, pp. 145-154.

Auchmeromyia luteola, F.—This fly is distributed throughout the whole of the Belgian Congo and occurs all the year round. It has only been met with inside or in the immediate vicinity of dwellings, and the species is considered to be as specific a parasite of man as is *Clinocoris* (*Cimex*) *lectularius*, L. Its dispersal from one village to another probably takes place in the egg or larva stage in the dirty mats which the natives take about with them. At Bukama, where the Sleeping Sickness Mission took up their quarters on a hill covered with scrub from which all traces of human occupation had vanished, the fly was frequently met with in the newly constructed huts within three weeks.

Everywhere where the soil was slightly damp and not too hard, numerous eggs were found in the dust, their shape and characteristic markings making them easily recognisable. The young larvae emerge from the egg by a longitudinal fissure extending from the pointed end to half the length of the egg.

Cordylobia anthropophaga, Grünb. This species is very widely distributed in Katanga, but appears to be very rare in the higher parts of the country, especially at Elisabethville, where, for a period of several months, no case of cutaneous myiasis of man or domestic animals came under notice. On the other hand cases were exceedingly common in the region of Lake Mweru, where several Europeans have been attacked by the cayor worm. At Lukonzolwa, in January 1912, all the domestic rabbits were infested with larvae of *Cordylobia*, the testicles and posterior paws being frequently attacked. Dr. Ranchon saw a cayor worm in a facial tumour of a negro at Pweto. Larvae were found in dogs at various places, and once in a captive wild cat (*Felis caligata*); while of a herd of sixty-one goats that came to Sankisia five were suffering from myiasis. Human myiasis was observed in three natives from Kalengwe, and Dr. Van den Branden was twice enabled to observe attacks upon himself.

All the recorded cases occurred in the rainy season; at Katanga numerous cases were observed between October 23rd and March 27th but there was none in the dry season. The fly probably deposits its eggs where there is a smell of animal or human perspiration. The infection of animals probably proceeds from the ground; as this is the only way to explain the position of the tumours, which are almost always found on parts of the skin coming into immediate contact with the ground, in one way or another. The cayor worm, in animals, shows a marked preference for the skin of the scrotum. In man, on the contrary, the fly lays its eggs on clothes, etc., impregnated by perspiration.

Specimens of *Auchmeromyia* (*Cordylobia*) *praegrandis*, Aust., were observed at Sankisia and Bukama. Bezzi considers that its biology is analogous to that of *A. luteola*, but the fact that four specimens were taken in urinals leads the authors to suppose that the larvae of this species are nourished on decomposing organic matter.

[Roubaud has recorded (see this Review, p. 69) that *A. praegrandis* is parasitic on the ant-bear (*Orycteropus*).—Ed.]

Hadwen (Seymour). **The Life-History of** *Dermacentor variabilis*. —*Parasitology*, v, no. 4, Jan. 1913, pp. 234-237.

After attempts extending over a period of three years, *Dermacentor variabilis* has been reared through its various stages on tame rabbits.

In Manitoba, as soon as the snow disappears and the warm weather begins, adults are common everywhere and a great annoyance to man and beast, but there is no record of larvae and nymphs having been taken at this season, probably because no systematic search has been made for them. Most of the gorged females used in these experiments were obtained in June—the earliest being on May 25th and the latest on July 17th—on man, cattle, horses and dogs, these being the only known hosts for Manitoba.

Copulation has not been observed, but it probably takes place on the host, as males and females are usually present in approximately equal numbers. Oviposition is similar to that of other ticks. A very slightly gorged female removed from the host will lay a few eggs and these partly gorged females, as in *D. albipictus* and *D. venustus*, are far more tenacious of life than fully gorged and ungorged females. At first the larvae do not take kindly to the rabbit as a host, whilst on a fowl they became very active but refused to remain on the bird. When not upon a host the immature ticks require moisture. After the last moult small whitish droplets exude from the bodies of the nymphs. In the dry climate of Manitoba this secretion is probably a protection against desiccation.

The conclusions are that *D. variabilis* is a three-host tick and can be raised experimentally on the rabbit. Starting with an adult female in the spring, it is very probable that the life-cycle is carried as far as the nymphal moult during the summer and autumn, and that the winter is passed in this state, the adults emerging in the spring. Under laboratory conditions about 210 days are required for adults to issue, reckoned from the time when the gorged mother tick abandoned the host, without taking into account the variable period which the tick may have to wait for a host when unfed.

NUTTALL (G. F. H.). **Spirochaetosis.**—*Parasitology*, v, no. 4, Jan. 1913, pp. 262-274.

A useful résumé of our present knowledge of this disease and of the ticks and insects which transmit it.

VANDERIJST (P. H.). **Notes sur quelques maladies des animaux domestiques dans le Bas-Congo.** [Notes on diseases of domestic animals on the Lower Congo.]—*Revue Zool. Africaine*, ii, pt. 2, 15th Feb. 1913, pp. 167-170.

At Kimpako the goats, to the number of 40, were all attacked by mange, very probably *Sarcoptes scabiei*, var. *caprae*. They succumbed rapidly and many had to be killed. The remainder were considerably emaciated and their hair came off. Mange of the ear-ducts is not rare among the goats of the Kisantu region; it is due to *Psoroptes equi* var. *caprae*, as Prof. Gedoelst has shown. This mange is not dangerous if animals attacked are carefully tended at the beginning of infection. *Chorioptes caprae*, called by the natives *makwanza* also produces a mange. *Makwanza* is also the term used for human mange, a very common, but usually not dangerous disease.

As a general treatment mangy animals should be lathered freely with black soap, and then immersed in an arsenical dip. In mange of the ear-passages, it is necessary to take off the crusts which obstruct the ear; these are often very hard, but may be softened with palm oil. After this operation the ear should be bathed with a mixture of equal parts of palm oil and petroleum.

BEQUAERT (J.). ***Conostigmus rodhaini*, sp. n., Proctotrypide endoparasite des pupes de *Glossina palpalis*.** [*Conostigmus rodhaini*, sp. n., a Proctotrypid endoparasite of *Glossina palpalis* pupae.]—*Revue Zool. Africaine*, ii, pt. 2, 15th Feb. 1913, pp. 253-257, 1 plate.

In 1906, in Uganda, Bagshawe found pupae of *Glossina palpalis* each pierced with a small hole from which a parasite had escaped, but neither he nor later observers succeeded in obtaining the insect. The hymenopterous parasite obtained from *G. palpalis* pupae at Katanga is a Proctotrypid of the sub-family CERAPHRONINAE. Numerous species of the genus *Conostigmus* are known in Europe and America, but no other has been described from the African Continent. Certain species are parasitic on the larvae of Syrphids and Cecidomyids and others are myrmecophilous; Hartig described some which had been obtained from the larvae of a beetle (*Bostrychus*). From a single pupa received from Bukama (Katanga) six of these parasites developed; nevertheless the insect must be very rare, for this was the only infested pupa out of 400 received.

RODHAIN (Dr. J.) & BEQUAERT (Dr. J.). *Gedoelstia cristata*, **gen. nov., sp. nov., Oestride parasite de** *Bubalis lichtensteini* **au Katanga.** [*Gedoelstia cristata*, an Oestrid parasite of *Bubalis lichtensteini* in Katanga.]—*Revue Zool. Africaine*, ii, pt. 2, 15th Feb. 1913, pp. 171-186.

Gedoelstia cristata, of which larvae, pupae and three adults were obtained, is a new species parasitic on Lichtenstein's Haartebeest. This antelope is very common in Katanga and in almost all of those that were examined numerous Oestrid larvae were found lodged in the long cavities of the frontal sinuses.

The majority of the larvae belong to the species here described, but along with them were found two examples of another species, as yet unnamed. Four species of Oestrids are now known from *Bubalis lichtensteini*.

RICHARDSON, Junr. (C. H.). **An undescribed Hymenopterous Parasite of the House-Fly.**—*Psyche*, xx, no. 1, Feb. 1913, pp. 38-39, 1 plate.

In the summer of 1912, a number of specimens of an apparently undescribed Pteromalid belonging to the genus *Spalangia* were reared from the pupae of *Musca domestica*. *Spalangia muscidarum* closely resembles *S. rugosicollis*, Ashm., and specimens reared from *Stomoxys calcitrans* in Texas agree in detail with those reared from *Musca domestica*.

This ecto-parasite, though commonly found in the puparia of house-flies, was not known with certainty as a parasite of other species. The Texas specimens, however, were obtained from a region where *S. calcitrans* and *M. domestica* were breeding in close proximity to one another and as their puparia are very similar it is reasonable to suppose that the parasites did not discriminate between the two.

BRITTON (W. E.). **Mosquito Control Work in Connecticut in 1912.** —*Jl. Econ. Entom.*, vi, no. 1, Feb. 1913, pp. 89-93.

During 1912 considerable work was done in trying to control the mosquitos along the shore region of Connecticut. A beginning was also made in draining the marsh areas. Draining and oiling was tried round New Haven, beginning with the most important breeding places. Oiling was practised on many fresh-water pools and also on the salt marsh, and results showed that even salt marsh mosquitos could be controlled by oiling, although during July, August and September, when breeding is at its height and the grass is tall and flooded at the roots, it is well nigh impossible to cover the water with oil. It should only be applied on the subsidence of the high tides, and then not until it appears that the adult may emerge before the pools become dry. Drains will last for many years if given slight attention each season and if kept from being clogged by floating debris.

Cooley (R. A.). **Notes on little known habits of the Rocky Mountain Spotted Fever Tick** (*Dermacentor venustus*, Banks).—*Jl. Econ. Entom.*, vi, no. 1, Feb. 1913, pp. 93-96.

The characteristic "waiting attitude" of this tick is described. The ticks were found to be excited by a sudden interception of the light falling upon them, and it is suggested that they are made aware of the approach of an animal by this means.

Hunter (S. J.). **Pellagra and the Sand-Fly.**—*Jl. Econ. Entom.*, vi, no. 1, Feb. 1913, pp. 96-101.

The author's investigations consisted of a survey of the distribution of *Simulium* in Kansas, an investigation of their habits, and inoculation experiments. The only species found to be generally distributed over the State is *S. vittatum*, the immature forms being found wherever there is trickling water. The species is not confined to clear water, nor even to rural districts. The females oviposit in the evening and place their eggs on wet leaves in shallow ripples or on rocks. As the fly oviposits she moves along, stringing the eggs, but holding on to the rock above water while the tip of the wings and abdomen are vibrating in the water. This process occupies about 10 minutes and 200 eggs are usually deposited. The duration of the egg stage depends somewhat on the temperature of the water, though usually lasting about a week. The length of the larval stage depends on the temperature and rapidity of the water. It varies from 3-4 weeks under good conditions, to several months in the overwintering stage. The pupal stage is usually 2-3 weeks. The length of the adult's life is not known, though those that have fed on human blood live longer than those that have not. There are two principal broods, one in July and one in October, though some emerge throughout the entire season. The flies appear to scrape the skin till blood oozes rather than to pierce it. The inoculation experiments failed owing to there being no pellagrin available in a proper stage.

The author's conclusions are that the number of cases of pellagra is proportional to the number of *Simulium*; the first appearance of pellagra is coincident with the principal broods; just succeeding the time of the principal broods the flies appear to bite more vigorously; flies fed on human blood live longer than others, thus favouring an incubation period for a parasite, if such there be; pellagra in Kansas has appeared almost entirely in one district where the flies are unusually abundant.

On the other hand pellagra has never been induced experimentally in any other animal. The appearance of pellagra in Kansas is of recent occurrence and nearly all the cases are those of natives who have never been out of the State.

Bishopp (F. C.). **The Stable Fly** (*Stomoxys calcitrans*, **L.**), **an important live-stock pest.**—*Jl. Econ. Entom.*, vi, no. 1, Feb. 1913, pp. 112-126, 3 plates.

A very severe outbreak of stable fly occurred in North Texas during August 1912, the flies breeding in large numbers in straw stacks. The great abundance of the fly was practically co-extensive with the great grain growing area.

Injury to live stock was brought about in a number of ways. Probably "worry" due to the attacks of great numbers of the flies was the most serious. Loss of blood was also by no means a small matter, as it was estimated that as many as a thousand flies might be present on a single animal at one time, so that the blood supply of the animals was heavily drawn upon. Many deaths were due to the fact that the weakening of the cattle induced acute Texas fever in those which already harboured the disease organism in their blood. The lessening of the milk supply in all milch cows throughout the affected area was an important source of loss, the milk output in some cases being reduced from 40-60 per cent. Loss of flesh in all animals in the fly zone was very noticeable. The stamping of horses often caused lameness, whilst swollen and stiff joints were commonly produced by animals standing too long in water to escape the flies.

At the same time the flies were especially numerous in other parts of the United States, notably in South Dakota and Georgia, also in Kansas, Nebraska and Southern Louisiana.

The stable fly breeds in the straw of various cereals and in manure. Examinations of accumulations of weeds failed to show the presence of *Stomoxys* larvae. Far more larvae appear to develop in oat straw than in that of wheat. Most of the flies breed in the lower portions of the stacks, although a few pupae were found on the top of a stack 15 feet high. After the larvae develop they show a tendency to work downwards or at least to follow the moisture as the surface of the stack dries. Pupation occurs anywhere in the straw, a favoured position being between the straw and the surface of the ground. It has been found that adults will feed in midday during very hot weather and also when the temperature is as low as 55° F. During rainy weather the flies are largely driven into sheltered places. In a large series of tests flies have been found never to oviposit before the third feeding on blood and usually four engorgements are necessary. There is no indication that reproduction ever takes place unless blood is engorged, and it is a common habit of these flies to partake of other liquid food. The eggs are laid preferably on rotting straw, singly or in bunches of 25 or 30. Oviposition usually takes about half an hour. Immediately after ovipositing the females are ready to feed again and this feeding is usually followed within a day by another deposition. The greatest number of ovipositions observed for a single fly was three, a total of 278 eggs being deposited. Experimental evidence indicates that fertilisation does not take place till the flies have partaken of blood.

Unfed flies only lived for two days; when supplied with water and sugar syrup one survived for 23 days; whilst individuals fed on blood at frequent intervals lived for 17 days. The length of the egg stage varies —from one to four days. Temperature and humidity, as well as the length of time the eggs are retained by the female, appear to affect the rapidity of incubation. The larval period varies from about eleven to over thirty days; in cold weather this stage would probably be much longer. The minimum developmental period from egg to adult is from 23-32 days, according to the character of food supplied. The pupal stage varies from six to about twenty days.

No records were taken of hibernation but an examination of stacks in the middle of December showed an abundance of larvae in various stages of growth and many pupae; active adults too have been found in December. The insect is usually much more numerous during the late summer and early autumn. The unusual plague in Texas in August and September was due to a large crop of grain, incidentally producing a great number of straw stacks, combined with the unusually heavy rains in early August. Many stacks were recently thrashed, and, being loosely piled, absorbed the rains as they fell. In a few days the entire mass became rotten and heated and thus afforded precisely the conditions most suitable for the reproduction of *Stomoxys*.

The larvae are able to withstand a great amount of moisture, often feeding on straw when it is saturated with water, and in the older larvae pupation is often hastened as a result of exposure to extremes of moisture and temperature. The drying out of straw stacks to a depth of six or eight inches largely prevents the deposition of eggs in these situations, the stacks under these conditions being unattractive to the adult fly.

Parasites have been found in numerous pupae of *Stomoxys*, two small Hymenoptera of the family PTEROMALIDAE having been bred in large numbers. One of these is *Spalangia muscae* and the other is an undetermined species of a different genus. Out of 2,500 pupae examined over 40 per cent. were parasitised by these two species. Experiments show that parasitism always takes place in the pupal stage. Both of the parasites have been found to attack the pupa of the house-fly and of the horn fly (*Haematobia serrata*), as well as other Muscid pupae.

During the outbreak of this fly predaceous insects were present in large numbers. Adults of *Stomoxys* were captured by many species of ASILIDAE, which were present in great numbers around straw stacks. Several species of spiders were seen to capture and devour the adults; while two or three species of mites were found to be enemies of the immature and adult stages. In manure and straw Histerid beetles were among the more important predators.

Straw stacks should not be allowed to rot, thus forming favourable breeding places for *Stomoxys*. All straw not required for winter feed for cattle should be destroyed by burning, or it should be scattered over the land soon after threshing and ploughed under subsequently. The use of poisons in quantities sufficient to permeate the stacks and kill the larvae would be very dangerous to stock. Whenever manure is mixed with straw it may be suspected of forming a breeding place for *Stomoxys*. The thorough scattering of manure at regular intervals, as is recommended for the control of the house-fly, is effective in stopping the breeding of *Stomoxys*. A mixture of fish oil, oil of tar and of pennyroyal, with a little kerosene, proved the most efficacious application to keep the flies off stock. Deep narrow trenches, the sides of which are oiled with petroleum, offer protection to hogs and sheep. The screening of barns is a good preventive measure.

GROSSBECK (J. A.). **The relation of Mosquitoes to their environment.**—*Jl. New York Entom. Soc.*, xxi, no. 1, March 1913, pp. 55-61.

An account is given of the habits and habitats of the commoner North American mosquitos. *Culex pipiens* is regarded as essentially a domestic species, breeding by preference in foul water. *Anopheles crucians* and four species of *Culex* breed only in salt marshes. Another group of species, including *A. punctipennis* and *A. maculipennis*, is to be found only in open fields and swamps; while the woodland pools yield quite a different set of species. Among the latter, *Anopheles barberi* and two species of *Culex* are restricted to the water in tree hollows.

Various examples of the adaptation of habits to environment are cited. Those species which deposit their eggs in rafts must avoid running streams, or pools in which they are likely to be found by enemies; hence their selection of temporary puddles and the shallow edges of protected pools. The selection of permanent water by *C. perturbans* and *C. melanurus* is due to the fact that they pass the winter in the larval stage. The salt marsh species oviposit when the meadows are almost dry, and the mud is then littered with eggs, which remain unhatched for a month, or a year, or several years, until covered with water, when the young larvae emerge. Of the forms that lay their eggs singly, those in which the eggs hatch in a few days, such as *Anopheles*, usually frequent the more open permanent swamps; while those in which the eggs sink and remain at the bottom unhatched for nearly a year, prefer woodland pools which last only during the spring months.

Some of the effects of water vegetation and temperature upon mosquito larvae are noticed, and details are given as to the geographical distribution of several species.

OSBURN (Raymond C.). **Tabanidae as inhabitants of the hydrophytic area.**—*Jl. New York Entom. Soc.*, xxi, no. 1, March 1913, pp. 63-65.

This paper contains some general notes on the breeding places of several North American TABANIDAE.

SCELSI (S.). **Pidocchi nei bovini.** [Lice on Cattle.]—*Rivista di Agricoltura, Parma*, xix, no. 15, 11th April 1913, pp. 232.

The misery caused to stalled cattle by lice is great in Italy, so much so that the animals are frequently not in a proper state to avail themselves of the fresh herbage when turned out to grass. The author recommends thorough washing with potash soap and before the animals' skins are dry to sprinkle them with wood ashes and to rub this well in with a brush; washing with a decoction of *Delphinium staphisagria*, made by boiling one part of the seeds in 15 of water; anointing the affected parts with a mixture of one part of creosote and 20 parts of olive oil and rubbing it well in with a brush; or finally, washing with a decoction of tobacco made by boiling 50 grams of tobacco in 1,500 grams of water until it is reduced to one litre. He points out that whichever of these remedies is made use of the application must be repeated for three or four days, in order to make quite sure that not only all the lice have been killed, but also the eggs, otherwise the trouble will at once return.

Pestiferous Fauna. How they breed and how to exterminate them.—*Suggestions issued by the General Board of Health, Bermuda*, 1913, 15 pp.

This is a small pamphlet issued for general distribution and explaining in simple language the dangers to health resulting from insect and other pests. A list of precautions necessary to preserve health is given, and the danger of the house-fly as a disease-carrier is specially emphasised. The usual methods for eliminating these insects are recommended.

As regards mosquitos it is said that three species only are of consequence in Bermuda, viz. *Stegomyia fasciata*, *Culex fatigans*, and *C. sollicitans* (salt-water mosquito). The conditions in Bermuda for the breeding of *Anopheles* are said not to be favourable. The generally accepted methods for the prevention of the breeding of mosquitos are given. The pamphlet concludes with some remarks upon rats, the manner in which they carry plague, and some methods of getting rid of them.

Sheep Scab in Ireland.—*12th Ann. Gen. Rept. Dept. Agric. Ireland*, 1913, pp. 159.

During the year ended 30th September, 1912, 338 outbreaks of sheep scab were recorded, as against 394 in 1911. Two dippings annually of all sheep throughout Ireland are required.

Bruce (Sir D.), Harvey (Major D.), Hamerton (Major A. E.), Davy (Dr. J. B.), & Lady Bruce. **The Trypanosomes found in the Blood of Wild Animals living in the Sleeping-Sickness Area, Nyasaland.**—*Proc. R. Soc., London*, Ser. B, lxxxvi, No. B. 587, 7th April 1913, pp. 269-277.

The plain adjoining the western lake-coast of Nyasa is partly covered with thorn-scrub which is the home of the tsetse fly and numerous wild animals. Samples of the blood of any animal shot by a member of the Commission were sent to a point on one of the main paths, from where a motor cyclist carried them to the camp at Kasu. On arrival the blood was at once injected into a goat, a monkey and a dog. Among the 180 animals procured from the heart of the Nyasaland Sleeping Sickness area 57 (or 31·7 per cent.) were found to harbour pathogenic trypanosomes. The species of the latter found are *T. brucei* vel *rhodesiense* 7·8 per cent., *T. pecorum* 14·4 per cent., *T. simiae* 1·7, *T. caprae* 11·1, and *T. ingens* (not pathogenic) 1·7. The animals infected are waterbuck, haartebeeste, reedbuck, duiker, buffalo, hyena, warthog, eland, oribi, kudu, and bushbuck, of which the first four are dangerous neighbours to man and the others to cattle, goats and sheep. The wild animals should not be allowed to live in 'fly-country' and game laws restricting their destruction should be removed. This only refers to wild animals living in fly-areas, no pathogenic trypanosomes having been found by the Commission in the blood of animals living in fly-free areas.

BRUCE (Sir D.), HARVEY (Major D.), HAMERTON (Major A. E.), DAVEY (Dr. J. B.), & Lady BRUCE. **Trypanosome Diseases of Domestic Animals in Nyasaland.** ii. *Trypanosoma caprae*, **Kleine.**—*Proc. R. Soc., London*, Ser. B, lxxxvi, No. B. 587, 7th April 1913, pp. 278-284.

The Commission did not meet with *Trypanosoma uniforme* or *T. vivax* in Nyasaland, possibly owing to the absence of *Glossina palpalis*. *G. morsitans*, especially in the neighbourhood of Kasu, are heavily infected with *T. caprae*, the development of which is restricted to the proboscis. *T. caprae* is not of pathological importance in oxen, but is fatal to goats and sheep. About 10 per cent. of wild game (reedbuck, waterbuck, bushbuck and eland) in the Nyasaland Sleeping Sickness area are infected, the carrier being invariably *G. morsitans*. Monkeys, dogs and the smaller laboratory animals are immune to *T. caprae*.

BEQUAERT (Dr. J.). **Tabanides recueillis au Congo belge par la Mission pour l'étude de la maladie du sommeil.** [Tabanids collected in the Belgian Congo by the Sleeping Sickness Mission.]—*Revue Zool. Africaine*, ii, pt. 2, 15th Feb. 1913, pp. 218-231.

This paper deals only with the PANGONIINAE, and is almost entirely systematic. Fifteen species were obtained, all from the Katanga district, *Pangonia bukamensis* and *Rhinomyza rodhaini* being described as new. Several alterations of names are suggested in connection with species previously described by Mr. E. E. Austen.

[Mr. Austen is of opinion that not one of these proposed changes is justified, a view in which the present writer concurs.—Ed.].

NOTICES.

The Review of Applied Entomology is intended to contain, month by month, abstracts of the latest information published concerning insects injurious to man or animals, as the carriers of disease; and to forests, fruit trees, crops or stored merchandise.

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Hebrant & Antoine. **Sur l'otite parasitaire du chien et du chat.** [On parasitic Otitis of the Dog and Cat.]—*Ann. Méd. Vét. Brussels*, no. 5, May 1913, pp. 261-263.

The parasite of this disease has received various names:—*Sarcoptes cynotis; Symbiotes auricularum; Chorioptes ecaudatus*, Raillet; *Otodectes cynotis*, Gedoelst; *Dermatophagus auricularis*, Marek.

Amongst the numerous cases observed at the clinique of the Ecole Vétérinaire de L'Etat in 1912, sixteen occurred in the cat and three in the dog. Cadiot and Breton have already noted that this is especially a disease of sporting dogs. The symptoms are those of ordinary auricular catarrh, but the ear is not quite so tender to the touch. The authors say that diagnosis is quite easy if a little of the cerumen be examined under the microscope after the addition of a drop or two of a 10 per cent. solution of caustic potash; the parasites become visible, and even with the naked eye small grayish white points can be seen which indicate their presence. The malady is contagious and it is exceedingly desirable to isolate the animal attacked and to disinfect the kennels.

Any parasiticide is useful as a curative agent, and the authors have found the following washes satisfactory:—warm soapy water; a 2 per cent. solution of cresyl; a 1 per cent. solution of potassic sulphide; a 2 per cent. solution of salicylic acid in alcohol; also a solution of naphthol in alcohol; not to mention various well-known antiseptic powders. They themselves prefer, however, a 10 per cent. solution of tincture of iodine in glycerine, or a 1 per cent. solution of liquid carbolic acid in linseed oil. The advantage of both these remedies is that they render mechanical manipulation unnecessary.

Bishopp (F. C.) & King (W. V.). **Additional Notes on the Biology of the Rocky Mountain Spotted-fever Tick.**—*Jl. Econ. Entom.*, vi, no. 2, April 1913, pp. 200-211.

Rocky Mountain spotted fever exists in its most virulent form in the Bitter Root Valley, Montana, where 70 to 80 per cent. of the cases prove fatal. Although the disease does not occur in all the territory infested by *Dermacentor venustus*, it is also known in Alaska, Washington, Oregon, Idaho, California, Nevada, Utah, Wyoming, and Colorado, and it probably occurs in British Columbia.

The adult tick is, with rare exceptions, the only stage which attacks man. The first appearance of the adults occurs shortly after the first warm days of early spring, and they are most numerous in April and May.

During June the number rapidly diminishes, so that by the first of July very few remain attached to hosts. Towards the latter part of summer, the adults begin leaving the plants upon which they rest while awaiting hosts, and crawl down beneath the grass and leaves; in fact after the beginning of August they seem very reluctant to feed. In higher altitudes their activity is continued to a later date. Hibernation may take place in either the larval or adult stage.

The mountain goat possibly serves as a reservoir for the virus of the disease and infected ticks in the immature stages may be carried by small wild animals, the ground squirrel (*Citellus columbianus*) and the woodchuck (*Marmota flaviventer*), from the higher altitudes to the lower regions where cattle graze.

Experiments showed the maximum longevity of larva to be 317 days and of unfed nymphs 376 days, whilst adults are capable of living more than 641 days. In the Bitter Root Valley, at any rate, the life-cycle of this tick requires from two to three years to complete, for the adults, under natural conditions, will not become engorged during the same season in which they transform to that stage.

A number of cases of paralysis have been reported as being produced by *Dermacentor venustus*. In nine cases of this trouble a tick was found attached in the hair below the occipital prominence. The symptoms subside rapidly after removal of the tick. The point of attack seems to be an important factor in producing these symptoms. In two instances nymphs have been found attached to man, and the fact is important because nymphs of this species have been shown to be capable of transmitting Rocky Mountain spotted fever. Very few specimens of nymphs have been taken on cattle in the North-western States.

STRICKLAND (C.) & MERRIMAN (G.). **Report on rat fleas in Suffolk and North Essex.**—*Parasitology*, vi, no. 1, April 1913, pp. 1-18, 3 charts. Republished from Forty-first Ann. Rep. of the Local Govt. Board, 1911-12.

Of a total of 822 rats examined, about three out of every four harboured fleas; the average number of fleas per rat was almost exactly 4, but one rat harboured 105, and several rats had 30 to 40 fleas upon them; rats captured on "model" or well-kept farms, had not fewer fleas upon them than others captured elsewhere. The rat from which 105 fleas were taken was caught on a "model" farm; the average number of fleas per rat varied considerably in various groups of parishes (0·6 to 6·5), but there is no explanation of this variation. A definite seasonal variation was observed in the number of fleas per rat and in the percentage of rats infested with fleas; there was a corresponding variation in the maximum and minimum temperatures in the grass-thermometer readings and in the atmospheric humidity; it was not determined exactly to what the closely marked seasonal variation in the average number of fleas per rat was due, but probably the temperature is the more important factor.

Fifteen species of fleas were found on the rats. *Ceratophyllus fasciatus* gave an average of 2·42 per rat, on adult recently killed rodents. Besides this, about 70 per cent. of the fleas caught on "nestling" rats were of this species, while of the fleas taken from rats found dead, either of injury or disease, about 90 per cent. were *C. fasciatus*. From this it appears that *fasciatus* deserts a dead rat later than do other species. No correlation was discovered between the sporadic cases of rat plague and the average number of *C. fasciatus* per rat. Altogether 1,986 specimens of *C. fasciatus* were obtained, of which 68 per cent. came from outhouses, &c., and 32 per cent. from the fields; this is in striking contrast with *Ctenophthalmus agyrtes*. The flea was also found on the following hosts:—man, stoat, mouse, ferret, and rabbit. In India this species can transmit plague from rat to rat (*Mus rattus*).

Ctenophthalmus agyrtes.—The rat appears to be the true host of this species, but it was also found on the stoat and ferret. The average per rat was 1·5 per cent., and no correlation was found between the presence of plague in rats in certain districts and the average number of *C. agyrtes*. Thirty-five of these fleas were taken from "nestling" rats (about 30 per cent.), while only five were taken from about 30 rats, dead of injury or disease. Possibly they leave their host very rapidly after its death. The seasonal variation of *C. agyrtes* apparently depends on temperature and moisture. It is a "country" flea, for 61 per cent. came from hedgerows and 39 per cent. from buildings. This species does not bite man, and its significance therefore is restricted to the possibility of its transmitting and keeping up plague infection from rat to rat.

The other species of fleas found on the rats were:—*Ceratophyllus mustelae* (17), *C. walkeri* (8), *C. gallinae* (2), *C. hirundinis* (1), *Archaeopsylla erinacei* (7), *Ctenopsylla musculi* (3), *Ctenophthalmus pentacanthus* (3), *C. bisoctodentatus* (4), *Pulex irritans* (2), *Hystrichopsylla talpae* (3), *Ctenocephalus canis* (2), *Palaeopsylla soricis* (1), and *P. minor* (1). Probably all these species had only an accidental connection with the rats, though it is possible that some of them might become important under other conditions.

Although only five rats were found with lice, it is interesting to note that many of the rodents were infected with *Trypanosoma lewisi*. Three females of *Ixodes tenuirostris* were found for the first time on rats, their usual hosts being shrews, voles, and harvest mice. *Haemogamasus hirsutus* commonly occurring in moles' nests, *Gamasus coleoptratorum*, *G. terribilis*, and *Notoedres* sp. (the cause of ear scabies) were also found, together with *Haematopinus spinulosus* and *Haematopinus* sp?

NUTTALL (G. H. F.) & STRICKLAND (C.). **Report on rat fleas in Cambridgeshire.**—*Parasitology*, vi, no. 1, April 1913, pp. 18-19. Republished from the Forty-first Annual Report of the Local Govt. Board, 1911-12.

The record relates to fleas collected from rats in and about Cambridge during the period from 3rd March 1909 to 20th November 1911.

By far the larger numbers of the fleas were *Ctenophthalmus agyrtes.* A few *Ceratophyllus fasciatus* and but one specimen each of *Pulex irritans* and *Ctenophthalmus bisoctodentatus* were found. The largest numbers of fleas per rat (*C. agyrtes*) were captured in February and March.

Robinson (L. E.) & Davidson (J.). **The Anatomy of** ***Argas persicus.***—*Parasitology,* vi, no. 1, April 1913, pp. 20-48, 6 plates.

A good account of the morphology of this troublesome pest of poultry. The species is stated to occur in all countries lying between the fortieth parallels of north and south latitude.

Brown (W. G.). **The Tandewanna Sheep Dip.**—*Queensland Agric. Jl.,* Jan. 1913, pp. 17-19.

The author says that during the past 12 months he has seen more lice- and tick-infested sheep on the downs than he believed possible, considering the amount of advice on the advantages of sheep dipping which has been poured over the country. He then states the advantages of dipping and the direct commercial benefits resulting, and gives an account of the dipping of 40,000 sheep at Tandewanna by a method which is an improvement on one said to have been invented by Mr. C. Keen of Gurley, New South Wales. This dip is essentially a shower bath, instead of a plunge, and has a flat tray roof perforated with holes under which sheep stand quietly while the liquid used is showered upon them. The specification is as follows:—The shed is 40 ft. long by 12 ft. 6 in. wide, the roof flat and covered with no. 22 gauge flat, galvanised iron, tacked (not soldered) at all seams (the leakage is said to be negligible) and perforated with no. 10 holes 3 inches apart. The iron is turned up all round the edge about 6 ins. The roof joists are 16 ins. by 2 ins., placed 18 ins. apart and run across the building. The height of the shower is about 6 ft. above the floor, which is made of corrugated galvanised iron (no. 22 gauge) and not battened, and is laid with a fall to the side of 2 ins. in 10 ft. across the shed. The channels of the corrugation lead into a gutter which carries the liquor draining off the sheep's back into the tank in which the dip is mixed. This is an excavation 8 ft. by 4 ft. by 4 ft., lined with flat galvanised iron and made water-tight, and from this a 3 in. centrifugal pump, worked from a 2½ B.H.P. engine, delivers the mixture on the tray roof of the shed, whence it falls in a gentle penetrating shower on the sheep standing beneath. The shed has a pair of gates at each end to hold the sheep. It has been found that there is no difficulty in persuading the sheep to go quietly into this shed ("dip shyness" is unknown) and that they are thoroughly wetted all over in 6 or 7 minutes. Four minutes more is sufficient to drain them, and thus a shed full of sheep may be dipped in 15 minutes allowing for filling and emptying. The capacity of this shed at Tandewanna is from 250 to 300 sheep, and 1,000 sheep per hour can be dipped without undue haste, by four men.

The author says that there is no reason why sheds of this kind should not be built on quite a large scale, or on the other hand sufficiently large to wet no more than 40 or 50 sheep at a time. The cost of such a shed he puts at £10, and says that a cheap 2 in. Douglas hand-pump or no. 8 semirotary pump will give excellent results. A sketch of the dip will be found in the February number of the Queensland Agric. Jl., page 90.

ZETEK (J.). **Determining the Flight of Mosquitos.**—*Annals Entom. Soc., America*, vi, no. 1, March 1913, pp. 5-21, 3 figs., 1 chart.

The determination of the flight of mosquitos at Ancon, Panama Canal Zone, has not only been of value from the scientific standpoint, but has led to the eradication of these insects from human habitations and thereby reduced the possibilities of transmission of malaria, yellow fever, &c.

It is essential, first of all, to have a reliable map of the region selected for experimentation. It must indicate the topography, roads, commercial projects and pollutions by oils or poisonous refuse of streams and ponds. At the central station, and, if possible, at stations where decided wind variations take place, an anemometer recording the velocity at hourly intervals and the eight main directions, should be in operation. A self-recording rain-gauge and porcelain cup evaporimeters should also be installed. The tracing cloth should be so ruled that, in addition to mosquito flight records, the quantity and duration of rainfall, cloudbursts, fogs, frosts, barometric pressure and temperature may be correspondingly registered. A similar tracing, made to correspond with the map, should indicate the extent of prairies, forests, forest fires, drainage, marshes, the geology of the region, &c.

Of the biotic factors influencing the occurrence of mosquitos, the abundance or scarcity of predaceous animals (dragon flies, robber flies, ants, toads, frogs, fish, bats, &c.) should be noted, and mosquito-breeding areas should be charted on small maps as a result of weekly or bi-weekly surveys. Plant-associations and the species of mosquitos found should also be recorded.

For the purpose of flight-determination, larvae and pupae should be collected in as large numbers as possible in a large white enamelled bucket and the contents strained through a clean piece of surgical gauze. This allows the débris and very young larvae to escape. The gauze should then be very carefully inverted over a wide-mouthed jar, so as not to injure the delicate larvae, and overcrowding should be guarded against. The jars are then transported to the field laboratory, and larvae and pupae bred out in white enamelled or porcelain plates. Careful observance of the environmental requirements peculiar to each species has reduced mortality among the larvae from 10 per cent. to less than one per cent. Special aerating devices and breeding cages are used, and invasions by mice, cockroaches and ants provided against. The adults are carried to the liberating stations, preferably in the early morning or evening, and stained in rectangular screen cages. Phenolphthalein or aqueous solutions of eosin, fuchsin, bismarck-brown, gentian-violet or methylene-blue were converted into a very fine spray through a vaseline-nebuliser, or a fine atomiser, and this spray is allowed to fall upon the mosquitos. The idea is not to encrust the mosquito, which is fatal, but only to place minute specks on the body. Staining should be performed only in the evening, and two hours before releasing the insects, in order to dry the stain thoroughly. As dark-coloured clothing is attractive to the mosquitos it is important to wear a light suit and to observe the clothing and habits of passing people.

The mosquitos found in buildings are best recovered by hand, and elsewhere traps (such as that designed by Mr. C. H. Bath), beating nets, or tents are used. The adults recovered are killed with sulphur dioxide in a closed chamber and placed in pill-boxes with an exact record of the number, species, locality, temperature, humidity, wind-direction and velocity, cloudiness, smoke, &c. The contents of these pill-boxes are wetted in the laboratory with a solution containing three parts of glycerine, three of alcohol and one of chloroform. The observer, who must be free from amnesic or general colour-blindness must confirm all colours recovered by a spectroscope. It is thus possible to work out most exact correlation charts, if all the precautions mentioned be observed.

Surcouf (J.). **La transmission du ver macaque par un moustique.** [The transmission of *Dermatobia cyaniventris* by a mosquito.] —*C.R. hebd. Acad. Sci., Paris*, clvi, no. 18, 5th May 1913, pp. 1406-1408, 2 figs.

In spite of the frequent occurrence of tumours caused by the larvae of *Dermatobia cyaniventris*, Macq., in tropical America, their presence as subcutaneous parasites of man and other mammals has so far not been satisfactorily explained. In 1900, Prof. R. Blanchard had observed large eggs arranged in packets on the ventral side of the abdomen of certain Central American mosquitos; and Dr. Moralès, of Costa Rica, asserted (1910) that the eggs of *Dermatobia* were laid directly on the abdomen of the mosquito, which then transported the larvae to the vertebrates; but it seemed incredible that *Dermatobia*, which is of the size of a blue-bottle (*Calliphora erythrocephala*), should be able to oviposit on the mosquito itself. In 1912, Dr. Nunez Tovar, of Maturin (Venezuela), succeeded in producing tumours, which after eleven days were found to contain larvae of *Dermatobia*, by placing specimens of the blood-sucking mosquitos *Janthinosoma lutzi*, Theo., carrying *Dermatobia* eggs, on various animals. The author received egg-carrying *Janthinosoma* from Dr. Gonzalez Rincones, of Caracas, who discovered that *Dermatobia* oviposits on leaves in damp places frequented by that mosquito. An examination of the eggs showed that they were surrounded by an adhesive cement and so arranged on the abdomen of the mosquito that their anterior poles, on which the micropyle is placed and from which the larva makes its escape, point downwards. The cement softens in water and becomes viscid. It seems probable that the eggs, not being very strongly attached to the leaves adhere to the *Janthinosoma* walking over the latter. The eggs that become attached to the thorax, wings or legs of the mosquito drop off, while those sticking to its abdomen remain there until the larva emerges and drops on to the mammal whose blood the mosquito is sucking. The two illustrations show *J. lutzi* carrying the eggs of *Dermatobia cyaniventris* and the anatomy of a larva of the latter.

MORRILL (A. W.). **Entomological Pioneering in Arizona.**—*Jl. Econ. Entom.*, vi, no. 2, April 1913, p. 185-195.

In many parts of Arizona the blood-sucking cone-nose (*Conorrhinus sanguisugus*) takes the place of the bed-bug as a household pest.

Prevention of Mosquito Bites.—*Revista del Instituto Agricola Catalán de San Isidro*, 5th Feb. 1913, p. 45.

A traveller in Louisiana, U.S.A., says that in those parts of the country in which mosquitos are a serious pest, the following method of driving them away is in use. A piece of camphor about one-third the size of a hen's egg is placed in a tin which is hung over the chamber-lamp, care being taken that it does not take fire. The camphor vapour is said to have effectively prevented the mosquitos from entering the house even when the windows were open. During several years' residence at a place in which at one time life was almost intolerable, the mosquitos seemed to disappear from the house, and his servant explained that he had got rid of them by burning pieces of camphor once or twice a week.

Means of preventing the attack of Mosquitos.—*Revista del Instituto Agricola Catalán de San Isidro*, no. 7, 5th April 1913, p. 108.

Various methods have been suggested for preventing the attacks of mosquitos, such as rubbing the exposed parts of the body with camphorated alcohol, oil of peppermint, lemon juice or vinegar. It is however stated that the following formulae are much more useful and that they can be employed by sprinkling a few drops of each on a napkin tied to the head of the bed or set close to it in a small open vessel.

(*a*) Essential oil of oranges 30 grms., camphorated alcohol 30 grms., oil of cedar 15 grms.

(*b*) Castor oil, alcohol and oil of lavender in equal parts.

(*c*) Essential oil of oranges 30 grms., liquid vaseline 120 grms. The vaseline considerably delays the evaporation of the oil and permits of the mixture retaining efficacy until the morning, when the mosquito which transmits yellow fever generally bites.

Mr. Reynold has modified Sannartz' formula as to the proportion of the ingredients, viz., 20 drops of essential oil of oranges to 30 grms. of liquid vaseline. A 25 per cent. solution of sulphate of potash mixed with oil of cassia has also been recommended.

PORTCHINSKY (I. A.). ДОМОВАЯ МУХА (*Muscina stabulans*, Fall.); ЕЯ ЗНАЧЕНІЕ ДЛЯ ЧЕЛОВѢКА И ЕГО ХОЗЯЙСТВА И ОТНОШЕНІЕ ЕЯ КЪ КОМНАТНОЙ МУХѢ [The domestic fly (*Muscina stabulans*, Fall.); its importance to man and his household, and its relations with the house fly (*Musca domestica*)].—ТРУДЫ БЮРО ПО ЭНТОМОЛОГІИ Ученаго Комитета Главнаго Управленія Землеустройства и Земледѣлія [Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture], x, no. 1, 39 pp., 32 figs. St. Petersburg, 1913.

The author states that *Muscina stabulans*, Fln., is a fly which is really very little known and has not been greatly studied, although it is a very important factor in the spread of various diseases; in this respect it is less dangerous than *Musca domestica*, but only because it appears in relatively small numbers in human dwellings. Nevertheless the habits of this fly as described by the author point to the injurious rôle played by it in human household economy. It is capable of breeding in various substances found in nature and only single individuals are as a rule met with in human habitations; otherwise the state of war which exists between this fly and *Musca domestica* in the larval stage, which was proved quite unexpectedly by the author's studies, would have led to the total extermination of the latter fly and to its substitution by the more dangerous and injurious *Muscina stabulans*.

The experiments of the author on the relations between the larvae of these two flies were rendered more difficult by the fact that *Muscina stabulans* is very unwilling to lay its eggs in captivity. Out of a number of female flies whose ovaries contained ripe, fertilised eggs only few actually oviposited, most of them dying before this was accomplished. In this *M. stabulans* differs sharply from *Musca domestica*. The larvae of these two flies live but a very short time peacefully together. Having completed the second stage, the larvae of *M. stabulans* follow and attack the larvae of *M. domestica* and very soon exterminate all that happen to be living along with them. The author describes some interesting observations made by him, in which quite young larvae of *M. stabulans* becoming sensible of the presence of a full-grown larva of *M. domestica* immediately attacked it, twisting round and holding on to it by means of the small hooks situated on the under surface of their bodies, striking their victim powerful blows with their mandibles (small mouth hooks) which pierce through the outer skin of the larva of *M. domestica* and the latter, soon ceasing to resist, succumbs. The author never observed that a larva of *M. stabulans* which had actually killed a larva of *M. domestica* devoured its victim alone; usually a number of other individuals joined in the consumption of the dead larva. The author also never observed the larvae of *M. stabulans* eating each other, as is the case with some other larvae (*Polyetes albolineata*). In some of his experiments the larvae of *M. stabulans* were fed with larvae of other flies, such as *Musca ovipara* or *M. cornicina*, taken from the dung of cattle. Although the latter larvae were generally fully grown, those of *Muscina stabulans* immediately attacked and quickly devoured them. On this live diet the larvae grew very quickly, and when fully developed, refused further live prey. Besides the living larvae of flies the author used fresh dead flies or other insects as food and found that the larvae bored into their bodies and ate the contents.

The experiments of the author with the larvae of *M. stabulans* and of *Hydrotaea dentipes* proved that the former also destroyed the larvae of the latter fly which, as is already known, are also carnivorous and destroy the larvae of *M. domestica*. In the opinion of the author the harm done by *M. stabulans* in destroying the larvae of a useful fly such as *H. dentipes* outweighs its utility as a destroyer of the larvae of the house-fly. There are, however, other species of flies, which destroy the larvae of *M. stabulans*. The larvae of *Polyetes albolineata* in horse-dung are, the author says, always victorious over those of *M. stabulans*, even when the latter are the larger, and he claims to have proved this by experiments. It is known that another species of *Muscina*, *M. pabulorum*, is a serious enemy of the larvae of *Sciara militaris*.

The larvae of *M. stabulans* have been found not only in human faeces and in the dung of cattle and horses, but also on raw and cooked meat, on carcases of different vertebrates (mammals, birds and amphibians) and invertebrates (insects, their larvae and pupae), in rotten bulbs and vegetables, on fungi, in old cheese, &c.

The author mentions statements of Goureau, Aubé and Laboulbène, who found on truffles large colonies of larvae of *M. stabulans*, instead of the larvae of the usual flies, *Helomyza gigantea* (*tuberivora*), *H. lineata* and *H. ustulata*, which live on these fungi; evidently the rotting truffles attracted the *M. stabulans*, the larvae of which had exterminated the former inhabitants.

The ability of *M. stabulans* to penetrate into all sorts of dark and closed spaces and rooms in which human food is preserved, and to infect this food with different pathogenic organisms, may lead to very serious consequences. Apart from various diseases which may be spread in this way, food on which the fly's eggs are laid, when consumed by human beings or other animals, especially in the case of individuals suffering from chronic disorders of the bowels, may bring about very grave and painful complications. For some unknown reason, the larvae of flies which in nature usually pass quickly through all their different stages, are in many cases able to remain in the human intestine in the larval stage for a much longer time. The author relates a case, which was brought to his notice by Dr. F. V. Mizerow, of Ufa, of a peasant in whose body the larvae remained, according to the opinion of the physician who treated the case, from about November 1909 to March 1910, causing during the whole period, great pain and sickness with vomiting. From January 1910 onwards his faeces contained blood. The last physician to whom the peasant applied ordered injections of a concentrated solution of tannin, and during the two days following these injections some 50 larvae of *M. stabulans* were passed, nearly all of which were alive and were identified by the author. Even in the bowels of quite healthy individuals where the larvae evidently cannot live very long, they may cause by their movements and their efforts to escape, great pain with symptoms of toxaemia, or so-called " false typhus." These symptoms are provoked by the mandibles of the larvae scratching and piercing the mucous membrane of the bowels. In addition to the blood lost and passed with the faeces, the numerous small wounds so produced on the intestinal walls allow the various microbes and toxins of the bowel-contents to pass into the blood. The author quotes several cases described in the old and more recent literature on this subject of illness caused by the presence of the larvae of *Muscina stabulans* in the body. In some cases there is no doubt that the larvae which have been passed by the patients belonged to this fly, as the physicians who describe the cases were able to breed the fly from the larvae. In other cases where the larvae passed have been attributed to other flies the author is of opinion that the diagnosis was probably erroneous and that in most of the cases described they were those of *Muscina stabulans*.

The author gives a detailed description of *Muscina stabulans* and of its habits, and points out at length the differences between the eggs of this fly and those of *Musca domestica*, as well as of two other flies commonly found in human dwellings, *Calliphora erythrocephala* and *Fannia canicularis*, all of the eggs being figured. *Muscina stabulans* may lay as many as 160 small eggs, spreading them singly or in lines over the whole surface of the object on which they are laid, which makes them more difficult to recognise than those of other flies. According to the author the larva of *Muscina stabulans* is very similar to that of *Musca domestica* and *Hydrotaea dentipes*, the difference consisting chiefly in the structure of the posterior stigmata and in the form of the breathing apertures enclosed in them. With regard to the mandibles of the larva, the hooks of which are very strong and so closely pressed together in the third stage that they appear as one hook, the author points out that in the second stage of the larva the hooks are widely separated from each other. The segment next to the head of the larva has on both sides of its forward end a rather wide stripe consisting of thin black lines of different lengths. These lines under strong magnification appear to consist of very small triangular spikes which evidently allow the larva to keep its head segment in the body of its victim while it is devouring it. The author confirms the statement of Bouché that this fly is able to go through all its transformations in about a month, thus being able to produce several generations during the summer.

PARIS (P.). **Un cas de myase intestinale.** [A case of intestinal myiasis.]—*C.R.* 41me *Session Assoc. Française pour l'avancement des Sciences* (Nîmes 1912), Paris, 1913, p. 447.

A young man (20), of Dijon, suffering from intestinal haemorrhage and complaining of pains in the anal region was found to evacuate large numbers of dipterous larvae which could be referred to three species of *Anthomyia* and one of *Piophila*. Belladonna suppositories were without effect, but a decoction of absinthe leaves had satisfactory results, though numerous larvae subsequently appeared at regular intervals. After a few weeks a treatment with chloroform enemata and strong doses of thymol proved effective in curing this particularly severe case of myiasis.

NUTTALL (G. H. F.). **Observations on the Biology of Ixodidae, Pt. I.**—*Parasitology*, vi, no. 1, April 1913, pp. 68-118, 2 figs.

Although the life-history of five of the eight ticks described in this paper is already known, a completion of the records is desirable, as well as a uniform arrangement of the data collected. Of three species, *Ixodes putus*, *I. canisuga*, and *I. hexagonus*, little or nothing has hitherto been known regarding their biology.

The laboratory methods employed at Cambridge University proved to be satisfactory. The ticks were placed upon the ears or scrotum (which were enclosed in bags) of cattle or rams, or upon dogs, jackals, or smaller animals kept in specially constructed cages. When the ticks (nymphs or larvae) were replete and dropped off their host, they were transferred to wide-mouthed bottles containing earth and filter paper, moistened preferably with a 15 per cent. salt solution to avoid moulds. The egg-mass laid by each tick was placed in tightly corked tubes containing filter paper; in the case of the larvae due attention has to be paid to conditions of light and temperature.

Extreme care in recording the data is, of course, imperative, and Mr. B. G. Clarke made a daily inspection of the whole stock of ticks, making notes in the reports wherever necessary. By the use of narrow columns with short headings practically the whole life-cycle of a species could be recorded on a single sheet of foolscap. The record should indicate the time the tick remains on the host until it drops off gorged; data relating to larvae, nymphs, females and males, and their behaviour on different hosts; notes on copulation; time required from stage to stage; time elapsing before female oviposits, duration of oviposition, number of eggs laid by single females; longevity of larvae, nymphs and adults under stated conditions. Special methods were employed to determine the number of eggs laid by individual females.

Ixodes putus feeds upon a different host as a larva, nymph and adult respectively, but it has proved impossible to determine the duration of feeding under experimental conditions. Besides the data mentioned above Prof. Nuttall describes the results of a bite from this tick from personal experience.

I. canisuga is also a three-host tick, occurring in the nests of sandmartins. Attempts to raise this species under laboratory conditions failed, but it was ascertained that it laid a small number of eggs, according with the expectation that *Ixodes* parasitic upon hosts with fixed habitats lay fewer eggs, since they are less exposed to loss of life than species occurring upon wandering hosts.

I. hexagonus lives on three hosts and is also difficult to rear in captivity. There is no evidence that the male ever sucks blood.

I. ricinus larvae were found to carry *Piroplasma divergens* to a calf. The time required for metamorphosis from egg to nymph is approximately 175 to 185 days. The females laid 2,400-3,200 eggs and survived up to 10 days after oviposition. Unfed larvae were lively after 176 days at 10° C. in a corked bottle.

Haemaphysalis leachi is easily reared on different hosts and may run twice through its life-cycle in a year, C. P. Lounsbury even raising three generations in a year. It abandons its host on the approach of death, in which it differs from other ticks.

H. punctata is common on sheep, and, according to McFadyean and Stockman, may transmit *Piroplasma divergens*, causing British redwater in cattle. This tick also seeks a different host in the larval, nymphal and adult stages and completes its life-cycle in one to two years.

Hyalomma aegyptium requires three hosts, but on hedgehogs behaves like two-host ticks.

Rhipicephalus appendiculatus from S. Africa has been reared under experimental conditions by the author.

Young (T. C. M.). **Mosquitos in Assam.**—*Brit. Med. Jl.*, 24th May 1913, pp. 1136-1137.

The Ramna at Dacca is a recently cleared area on which the new Government offices and the residences of civil officials are built and covers about 2 square miles. Under the author's supervision the whole of this area was thoroughly cleansed and every possible breeding ground for mosquitos destroyed. Despite these measures the position was not materially improved, for even a gentle breeze from the south brought abundance of mosquitos from the breeding grounds in Dacca city, 1½ miles away, and the author came to the conclusion that in order to protect the cantonment properly it would be necessary to carry out similar anti-mosquito measures in Dacca city as well, involving an efficient surface drainage system which was estimated to cost 50 lakhs of rupees.

Macdonald (A.). **Is Yellow Fever Endemic in Jamaica.**—*Brit. Med. Jl.*, 17th May 1913, pp. 1083-1084.

In a paper read before the Jamaica branch of the British Medical Association the author comes to the conclusion that yellow fever is not endemic in Jamaica. The stringent quarantine regulations render the importation of yellow fever difficult, and in spite of the occurrence of *Stegomyia* all the year round and the fact that thousands of susceptibles are bitten, the only epidemics occurring in the hot months were limited to adult males and probably due to importation from Central America.

Mitzmain (M. B.). **The rôle of *Stomoxys calcitrans* in the transmission of *Trypanosoma evansi*.**—*Philippine Jl. Science*, vii, B, no. 6, Dec. 1912, pp. 475-519, 5 pl., 17 tables.

Only negative results were obtained in the attempts at direct mechanical transmission of surra with *Stomoxys calcitrans* which were induced to bite healthy animals (horses, monkeys, and guinea-pigs). The results of experiments indicate that *Trypanosoma evansi* does not develop in the body of the fly and could not be found in the latter beyond eighteen hours after feeding on an infected animal. Pathogenic trypanosomes were found in the proboscis of the fly thirty seconds after feeding on infected blood. Within one minute and thirty seconds the organisms were not present in the mouth parts in a form capable of infecting by inoculation into guinea-pigs. *Stomoxys* has been shown to provide through its bites the infection of *Musca domestica* and other dung flies. These flies have been proved to harbour the surra organisms for several hours. It is demonstrated that the individual glass-tube method is the most suitable for applying flies in feeding on experimental animals and for keeping flies for long periods under laboratory conditions. The paper concludes with a fairly extensive bibliography and photographs showing a screened stable for fly experiments with horses; an immobilised guinea-pig in a large glass jar for experiments with great numbers of flies; method of applying an unlimited number of *Stomoxys* to a monkey's tail enclosed in a large bottle; feeding of *Stomoxys* in inverted tubes on an immobilised monkey; and single tube application of *Stomoxys* on a guinea-pig.

Barber (M. A.). **The susceptibility of Cockroaches to Plague Bacilli inoculated into the Body Cavity.**—*Philippine Jl. of Science*, vii, B, no. 6, Dec. 1912, pp. 521-524.

Experiments made in the Biological Laboratory, Bureau of Science, Manila, show clearly that cockroaches may be infected by very large doses of virulent plague bacilli. It may be concluded that these insects, especially *Rhyparobia maderae*, are little susceptible to plague inoculated into the body cavity.

Sergent (E.) & Sergent (É.). **Études épidémiologiques et prophylactiques du paludisme.** [The epidemiology and prophylaxis of malaria.]—*Annales de l'Institut Pasteur*, xxvii, no. 5, 25th May 1913, pp. 373-390, 6 figs.

The current report on the investigations carried out by the Government of Algeria states that there was a marked recrudescence of malaria, especially in the Mitidja and Seybouse Valley district, in 1911, in comparison with 1910. It was ascertained that the defence zone in the latter district which had been fixed at 3 km. in 1910 and 1911 had been crossed by immense numbers of *Anopheles maculipennis*, whereas at Montebello a zone of 1,500 metres, and at Tourville and Sainte-Léonie of 1,000, has been found to be quite sufficient. The first autumnal rain-storms always seem to drive the *Anopheles* into human habitations, the subsequent warm weather in 1910 causing a particularly severe invasion. *A. maculipennis* were found in two swampy regions formerly considered devoid of Anophelines, one near the Douar Magra near Barika, and the other at Aïn-Sennour near Souk-Ahras. A phenomenon peculiar to the Seybouse Valley and the neighbourhood of Bône is that the numerous adult *Anopheles* persist from the autumn until mid-winter, frequently until the end of February. In the Mitidja, however, which is subject to the same climatic conditions, the flies disappear from November. Dr. Hubert observed in Oued-el-Alleug that all the inhabitants of one street facing open ditches at a distance of about 500 metres suffered from malaria, whereas no cases occurred in the adjoining block. The Anophelines evidently found nourishment close at hand and therefore had no inducement to fly further afield. A large number of cases are reported from the communes of Aïn-Touta and El-Milia, whereas Dr. Aucaigne states that Bourlier and Burdeau are exempt from malaria.

In addition to the drying up of puddles, swampy districts, &c., further progress regarding preventive measures has been made in Algeria by the planting of *Taxodium distichum*, willows and *Eucalyptus*, especially in the Mitidja districts. Experiments at Birtouta with sowing *Azolla* have failed. Especially in cellars, fly-traps were extensively used, a simple and effective apparatus consisting of a funnel containing some alcohol and fixed to the end of a stick which is held to the ceiling and causes the flies to drop off into the funnel. By this method more than 60,000 *Anopheles* were captured at Mondovi and Penthièvre. The anti-paludism campaign is being vigorously carried on by the authorities, who distribute a large amount of educational literature printed in French and Arabic, besides having given away 850 kilograms of quinine preparations during 1910-1911.

A mosquito, frog and dirt-proof tank.—*Queensland Agric. Jl.*, Jan. 1913, pp. 126-127.

A galvanised iron tank fitted with Messrs. Lewis & Newbury's patent strainer is figured, which consists essentially of a conical chamber or receptacle, within a closed tank, fitted with a draw-off tap at the bottom and a strainer at the top outside the tank. The water enters the chamber through this strainer from the outside, so that frogs and mosquitos cannot enter the tank with it. Any dirt settles in this conical container and can be drawn off by the external tap, whilst the water which is intended to fill the tank can only pass out of the dirt container through a pipe which is also covered with a fine gauze strainer. In addition to the tap fitted to the bottom of the dirt catcher, this is also fitted with a syphon so that in case of neglect to draw off the accumulated dirt through the tap, the syphon will operate automatically and empty the dirt catcher, and any water it contains, down to the level of the exit pipe for water from the cone into the tank.

Bishopp (F. C.). **The Fowl Tick.**—*U.S. Dept. Agric., Bureau of Entomology,* Circ. no. 170, 31st March 1913, 14 pp., 5 figs.

The fowl tick, 'blue bug,' 'bloodsucker' or 'tampan' (*Argas miniatus,* Koch) is a widely disseminated species, being an important enemy of poultry in Roumania, S. Russia, Persia, India, N. and S. Africa, Australia, Brazil, British Guiana, Panama, West Indies, Mexico, and U.S.A. In the last-named country it is a serious pest, causing an annual loss of many thousands of dollars, and occurs in greatest abundance in the warm portions of the arid and semi-arid region, *i.e.*, Western Texas, southern New Mexico and Arizona, and Western California. It has also been reported from Florida and Iowa, but it will probably never become a pest of continuous importance in the States east of Texas on account of their humid climates.

Although the chicken is the host most frequently attacked, *Argas miniatus* also infests pigeons, ducks, geese, turkeys, ostriches and canaries. It has been reported as occurring occasionally on cattle and jack rabbits, but there are no authentic reports of its attacking man in the U.S.A. It may cause death in poultry either directly through 'tick worry' or indirectly by conveying spirochetosis. The poultry farmer sustains further losses through the pest lowering the vitality of the fowl, so as to make the latter more susceptible to disease, also by its greatly reducing egg-production, disturbing sitting hens and stunting the growth of chickens.

The eggs of *Argas miniatus* hatch in from 10 to 100 days. The larvae, or seed ticks, attach themselves to a fowl, feed from 3½ to 10 days and then drop off, mainly at night, and secrete themselves in protected places. In from 4 to 7 days the larva moults and the eight-legged nymphs again attach themselves to a host, this time engorging themselves within a few hours, and again drop off and secrete themselves at night. This process may be repeated seven times, and oviposition occurs soon after mating, an average of 537 eggs being deposited by each female tick. It is possible for the tick to complete its life-cycle in about 40 days, but the number of generations annually has not been determined, though there may be about five in the southern area of its distribution.

The tick has remarkably few natural enemies; the little black ant (*Monomorium minutum*) and some of the house-inhabiting spiders destroy eggs and larvae, and rats and mice are also concerned in its destruction. Chickens eat the tick with avidity, but the latter is greatly protected by its habits of night-feeding and hiding in cracks during the day. As regards artificial control, stringent quarantine measures should be resorted to before letting foreign poultry into tick-free yards. If an infested chicken-house is of little value it should be burnt. In other cases it is necessary to remove any unnecessary boards, boxes, &c., which may form a hiding place for ticks, and to spray the house with pure kerosene, crude petroleum (Beaumont oil), creosote, whitewash containing carbolic acid, strong kerosene emulsion, boiling water, or any of the standard tick dips. The application of hot tar is useful to fill up the cracks and seal up the ticks already in them. The chicken tick has been found to be one of the most difficult forms of animal life to destroy, insect powders and fumigation with hydrocyanic acid being entirely inadequate. Dipping the birds in gasoline destroys every tick attached to them, but this treatment is too harsh to be recommended. A very simple and inexpensive method of protecting fowls is to suspend the roosting perches, which should be absolutely smooth and free from bark, by means of small wires from the ceiling. Wires should also be run from the perches to the side of the building in order to prevent the framework from touching at any point. Applications of insecticides also destroy the chicken mite (*Dermanyssus gallinae*, Redi) and the chicken flea (*Echidnophaga gallinacea*, Westw.), which are of considerable importance in the U.S.A. The fowl tick can be kept completely out of a poultry farm by scrupulous cleanliness and constant vigilance. In Texas the introduction of tick-proof houses built of corrugated iron has kept the pest out. Wire nests which may be thoroughly cleaned by burning the straw in them and holding the wire part over the blaze, or tick-proof boxes isolated by means of legs set in dishes filled with kerosene are desirable.

DRAKE-BROCKMAN (Dr. R. E.). **Ticks and Relapsing Fever in Somaliland.**—Reports to the Colonial Office, dated 6th April and 16th April 1913.

Dr. Drake-Brockmann reports the outbreak in Bulhar of an epidemic of relapsing fever, a disease never before recorded from Somaliland. An examination of a large collection of ticks from the infected Midgen and adjacent Dolhabanta haffas failed to reveal *Ornithodorus moubata*, the tick transmitting relapsing fever in British East Africa. However, a closely allied species, *O. savignyi*, was found, which probably transmits the disease in Somaliland. As this tick occurs in large numbers in the native huts in Berbera it is likely that the disease will spread to that town.

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Graybill (H. W.). **The Action of Arsenical Dips in Protecting Cattle from Infestation with Ticks.**—*U.S. Dept. Agric., Bureau of Animal Industry*, Bull. 167, 15th April 1913, 27 pp.

Dips act both in a directly destructive way and in a protective manner by preventing infestation. The protective action of a dip may be destructive or repellent. The influence of dips on oviposition and the viability of the eggs is a factor in efficacy. The ingredients of home-made arsenical dips and the known or probable function of each ingredient are discussed. It is suggested in the bulletin that any protective action that the usual arsenical dips might have would be expected to be due to a toxic rather than to a repellent action. Watkins-Pitchford has shown that cattle dipped in arsenic are poisonous to ticks. Ticks are destroyed by dips either by suffocation or by poisoning, or by both means. Tests were conducted showing that ticks are suffocated by the closing of the spiracles, Canada balsam causing death very soon, while Beaumont oil proved less effective, and cotton seed oil was practically without effect. Smearing the scutum and mouth parts of engorged females with oils and viscous substances had no influence on the mortality, or oviposition, or on the percentage of eggs hatching. Beaumont oil had a marked influence on the number of eggs deposited and on the viability of the eggs, whereas cotton seed oil had no effect.

Three cattle-dipping experiments were conducted with an arsenical dip containing 8 pounds of arsenic trioxide to 500 gallons of water, in order to test its protective action against tick infestation. Seed ticks were placed on the cattle in the first experiment at periods ranging from a few hours to four weeks, in the second from a few hours to two days, and in the third at five days after dipping. It was found that the dip rendered no protection when the exposure to infestation was five days or longer after dipping. The limit of protection ascertained in the experiments was two days. Arsenical poisoning which occurred among the calves in one experiment was apparently caused by undissolved arsenic in the dip (white arsenic does not dissolve readily unless the water be kept boiling).

As a result of incidental observations made on engorged female ticks from animals suffering from Texas fever it was found that the mortality of such ticks varied from 40 to 95 per cent. and was higher among those taken from the undipped control animal than those from the dipped animals. It is known that the mortality among ticks taken from animals suffering from Texas fever is abnormally high, so that the results are somewhat inconclusive as to the part played by the arsenical dip.

Krontowski (Dr. A.). **Zur Frage über die Typhus- und Dysenterieverbreitung durch Fliegen.** [On the dissemination by flies of typhus fever and dysentery.]—*Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten, Jena*, lxviii, no. 7, 23rd April 1913, pp. 586-590.

Larvae of *Sarcophaga carnaria*, *Lucilia caesar*, *Sarcophaga* (*Cynomyia*) *mortuorum*, and *Musca domestica* were infected with *Bacillus typhi* and *B. dysenteriae* and allowed to pupate. An examination of the excreta of the flies failed to reveal the presence of the bacteria, nor was it possible to infect milk by bringing it into contact with flies so bred. As regards the transmission of typhus fever and dysentery by adult flies, the author elaborated Auché's experiments and came to the conclusion that the bacteria can retain their virulence when on the feet or proboscis, or in the alimentary canal of the fly, whence they are eventually voided with the excreta. Wherever flies have free access to victuals as well as infectious human faeces the danger of epidemic typhus or dysentery is great.

KLEINE (Dr. F. K.) & ECKARD (Dr. B.). **Zur Epidemiologie der Schlafkrankheit.** [On the epidemiology of sleeping sickness.] — *Arch. f. Schiffs- und Tropen-Hygiene, Leipzig*, xvii, no. 10, May 1913, pp. 325-328.

The possibility of the formation of anti-bodies in tsetse-flies infected with *Trypanosoma congolense* is of importance in explaining the sudden disappearance of sleeping sickness in certain areas. The authors fed a large number of female *Glossina* daily on monkeys and goats infected with that trypanosome, in order to induce the formation of anti-bodies in the flies. After three weeks the pupae deposited were collected, and later on, from 12th Sept. to 2nd Nov. 1912, the freshly emerged flies, 434 in all, were fed on different infected monkeys for 4 days, and then for a fortnight on healthy animals. On the 18th day the 402 surviving flies were killed and examined, with the result that 11, *i.e.*, 2·7 per cent., were found to be infected. Of 90 flies killed one month after feeding on infected animals three infected ones were found. Flies, of which the mothers had only been fed on diseased animals, failed to show any infection after feeding on healthy animals. The authors conclude that tsetse-flies infected with trypanosomes do not produce anti-bodies that may be transmitted to the next generation, nor can immunity be admitted as an explanation of the long duration of sleeping-sickness.

BREHME (H. H.). **Notes on Mosquitos.**—*Entom. News. Philadelphia*, xxiv, no. 6, June 1913, pp. 242-245.

Owing to heavy showers in August 1912 mosquitos were extremely prolific in the southern part of New Jersey, and numerous complaints, especially from Barnegat Bay, were received by the author, who is in charge of the mosquito extermination work at the Agricultural Experiment Station, New Brunswick, N.J. *Aedes sollicitans* proved to be the most troublesome species, and *Culex pipiens* predominated in Hudson Co., but was controlled in Union Co. by the continued oiling and filling in of the breeding places. *Anopheles maculipennis* was very abundant throughout the State, especially in swamps in Mercer Co. *A. punctipennis* was extremely prolific near Princeton. Odd specimens of *A. crucians* were found on the salt-marsh along Barnegat Bay. *Psorophora ciliata* was rare and its breeding places in Essex Co. have been eliminated. *Aedes sayi* was a pest to man and animals during the latter part of August. *Aedes cantator*, formerly more abundant than *A. sollicitans*, is now outnumbered by the latter. *A. sylvestris* appeared in vast swarms in May and June. Inspectors appointed by the Extermination Commission also recorded the occurrence of *A. taeniorhynchus*, *A. sylvestris*, *A. triseriatus*, *A. pretans*, *A. dupreei*, *A. subcantans*, *A. abfitchii*, *A. canadensis*, *Culex restuans*, *C. salinarius*, *C. territans*, and *Wyeomyia smithii*.

ORENSTEIN (Dr. A. J.). **Mosquito Catching in Dwellings in the Prophylaxis of Malaria.**—*Amer. Jl. Public Health*, iii, no. 2, February 1913, pp. 106-110.

Catching mosquitos by hand is an extremely valuable measure in the prophylaxis of malaria, especially in temporary camps. In the Panama Canal Zone, West Indian negros, with very little training, performed this work satisfactorily for 10 cents an hour. It is advisable to have the dwelling well lighted and the walls painted a light colour or whitewashed. In screened buildings hand-catching may be supplemented by properly designed and installed mosquito traps. A six-inch square wire gauze attached to a two-foot stick makes an effective mosquito 'slapper.' This and a bottle 4½ inches long and 1 inch in diameter, containing rubber bands cut into short lengths packed into a layer about an inch thick and kept in place by a plug of cotton wool soaked with a few cc. of chloroform, is all the equipment needed by the negro fly-catcher. Having spied an Anopheline the catcher uncorks his bottle and gently but rapidly places it over the insect, which is overcome by the chloroform fumes and drops into the bottle.

Quarantine for Texas Fever of Cattle.—*U.S. Dept. Agric., Bureau of Animal Industry*, 1st March 1913.

The United States Bureau of Animal Industry has issued a map showing the counties in each State against which quarantine is exercised for Texas fever of cattle. The States involved are:—Florida, practically the whole of Georgia and Alabama, the greater part of Mississippi and Arkansas, the whole of Louisiana, the greater part of Texas and Oklahoma, large portions of South Carolina, about half of North Carolina and 6 counties of Virginia, and also practically the whole of the southern half of California.

Texas fever is spread by the species of cattle tick known as *Margaropus annulatus*. Since 1906 the Federal Government and State and local authorities have been engaged in co-operative work for the extermination of these ticks. The boundary of the tick-infested territory at the time of the beginning of this work, and the areas freed from ticks and released from quarantine as a result of the progress so far made, are indicated on the map.

Lamoureux (A.). **Présence d'*Ornithodorus moubata* dans un foyer de fièvre récurrente à la côte ouest de Madagascar.** [Occurrence of *Ornithodorus moubata* in a centre of recurrent fever on the West Coast of Madagascar.]—*Bull. Soc. Path. Exot.*, vi, no. 3, 12th March 1913, pp. 146-149, 1 map.

The author communicated to this Society on the 8th May 1912 the fact that 3 cases of recurrent fever had been observed on individuals travelling by land on the West Coast of Madagascar, between Morondava and Majunga, and since that time 22 fresh cases have been noted. An examination of the hospital records of the military station at Majunga revealed the fact that numbers of cases, probably of this disease, had been recorded. The author quotes a statement made by R. Drury in an account of his journey and captivity in Madagascar from 1702 to 1720, in which he says that very few persons will enter the houses of the Vazimbas from fear of an insect resembling the Cow Tick which the natives call "Poroponjy." Drury further says that this insect is only found among the Vazimbas, who propagate it purposely so that the Sakalaves should not come into their houses; that those who are bitten by this insect are ill from 6 weeks to 2 months; that the insects attach themselves to the skin or even burrow under it, but that once an individual has been bitten and has been ill, he need no longer fear them, nor will he be further annoyed by them no matter how great their numbers may be.

Lamoureux regards this as a most satisfactory proof of the existence of recurrent fever in Madagascar and of its transmission by ticks 200 years ago. The author exhibited three specimens of *Ornithodorus moubata*, which were found in the infected area.

Rodhain (J.), Pons (C.), Vandenbranden (F.), & Bequaert (J.). **Note sur les Trypanosomides intestinaux d'*Haematopota* au Congo belge.** [Note on the intestinal Trypanosomes of *Haematopota* in the Belgian Congo.]—*Bull. Soc. Path. Exot.*, vi, no. 3, 12th March 1913, pp. 182-184, 1 fig.

The authors have found flagellates in the intestinal tract of 21 specimens of *Haematopota*:—one *H. duttoni*, Newstead, and the others *H. vandenbrandeni*, sp. n. They propose to name this new parasite *Crithidia tenuis*.

Bruyant (L.) & Joyeux (C.). **Un nouveau rouget des animaux en Guinée française (*Microtrombidium guineense*, sp. n.).** [A new Trombidiid mite from French Guinea.]—*Bull. Soc. Path. Exot.*, vi, no. 3, 12th March 1913, pp. 202-205, 1 fig.

The authors have observed the larvae of this mite, which they describe and figure, on the skin of fowls and monkeys at Kouroussa on the Niger, in Upper French Guinea. They have also discovered great numbers of *Dinotrombidium tinctorium*, L. (1758), of a very large size, nearly 10 mm. long, which, in their opinion, cannot be considered to be the perfect form of the *Microtrombidium* which they describe. The former appears after rain and remains for a time on the surface of the soil and once it has hibernated does not appear again; thus in the year 1911 it appeared for the first time on the 5th April immediately after a tornado and was seen for the last time on the 19th July. Attempts to breed *Dinotrombidium tinctorium* failed.

LEGENDRE (J.). **La prophylaxie des affections causées par les moustiques et la destruction de ces insectes à l'état adulte.** [The prophylaxis of affections caused by mosquitos and the destruction of these insects in the adult stage.]—*Bull. Soc. Path. Exot.*, vi, no. 3, 12th March 1913, pp. 205-209.

The author says that for several years he has insisted upon the necessity of destroying adult mosquitos, and that he has pointed out that the use of the ordinary entomological net will give remarkable results. He quotes the opinion of Colonel Gorgas, whom he consulted as to the value of this method in Panama, to the effect that where it was difficult to find and destroy the breeding places, the use of the net was very valuable and assisted greatly in keeping down the average number of cases of malaria. A tool called a "slapper" made of a piece of wire gauze about 4 inches square, fastened to the end of a stick, was employed with great success to kill mosquitos resting on walls or on dark-coloured clothing and furniture, and was found to be especially useful in the hands of children, who have sharper eyes than adults. He quotes from Ross' "Suppression of Malaria" a comparison between a block of workmen's houses in which the capture of adult mosquitos was regularly practised, and some barracks, 3 miles from Panama, in which nothing was done in this direction, with the result that the number of cases of malaria amongst the soldiers was 42, as against 1 amongst the labourers; during a period of 30 weeks, the average number of *Anopheles* killed daily in the workmen's dwellings was about 40.

The author insists that the idea that a mosquito is exceedingly difficult to capture, either in flight or when at rest, is entirely wrong, and he urges that the capture of adult mosquitos should be made quite as much a matter of course as the sweeping of a house.

CHATTON (E.) & ROUBAUD (E.). **Sporogonie d'une hémogrégarine chez une tsétsé (*Glossina palpalis*, R. Desv.)** [Sporogenesis of a Haemogregarine in *Glossina palpalis*.]—*Bull. Soc. Path. Exot.*, vi, no. 3, 12th March 1913, pp. 226-233, 2 pls.

The authors describe and figure this Gregarinid which was found in the body cavity of tsetse-flies taken on the banks of the Casamance at Kolda, in Senegal, and remark that this adds one more to the list of Protozoa transmitted by these flies, and constitutes the first case actually noted of the evolution of a Haemogregarine in a biting Dipteron. It is the second case of an insect intervening in the developmental cycle of these blood-parasites, the first having been reported by Christophers in the case of *H. gerbilli.*

MAYER (T. F. G.). **A New Mosquito-proof and Storm-proof House for the Tropics.**—*Ann. Trop. Med. and Parasit., Liverpool,* vii, no. 1, 31st March 1913, pp. 41-44, 1 pl.

Messrs. Humphreys Ltd. have designed for the author a mosquito-proof house which embodies a number of new principles. It is constructed almost entirely of steel; where woodwork is used the wood is specially treated to withstand the attacks of termites and other insects. The house is built on a floor of concrete. The walls are continuous, consisting of a steel framing filled in completely with a specially woven, strong mosquito netting, placed between 2 layers of metal trellis-work, which prevent bulging. The roof, which is shut off from the room below by an asbestos ceiling, is ventilated by means of louvre windows at each end. Should the breeze blowing through the house be too strong or too cold, it can be cut off by shutters, which are provided all round the house. The house may be subdivided by screens and curtains but the chief aim in the method of construction is to make wall space and available ventilation area practically synonymous. The author points out that prophylactic treatment of malaria by mosquito protection alone, without quinine, according to Celli, means an infection rate of 2·5 per cent., whereas in the case of no protection the rate of infection is 33 per cent., and the use of quinine reduces these figures to 1·75 per cent. and 20 per cent. respectively.

BRUMPT (E.). **Evolution de** *Trypanosoma lewisi, duttoni, nabiasi, blanchardi,* **chez les puces et les punaises. Transmission par les déjections. Comparaison avec** *T. cruzi.* [Evolution of *Trypanosoma lewisi, duttoni, nabiasi, blanchardi,* in fleas and bugs. Transmission by the excrement. Comparison with *T. cruzi.*].—*Bull. Soc. Path. Exot.,* vi, no. 3, 12th March 1913, pp. 167-171.

The author cites authorities to the effect that *T. lewisi* is easily transmitted to a healthy rat by means of fleas and also, though not so easily, by the rat louse (*Haematopinus spinulosus*). Prowazek has made a complete study of the evolution of the parasite in the rat louse and the life-cycle of *T. lewisi* has also been studied by Minchin and Thomson. There is some difficulty in understanding how the fleas transmit infection to the rat. In many cases their rôle is mechanical, but normally they act as true intermediary hosts. Minchin and Thomson think that the fleas inoculate the rats with their proboscis. Strickland and Swellengrebel, whilst admitting the possibility of this, discovered that it is easier to infect a rat by causing it to eat infected fleas pounded up with bread. The author experimenting with the fleas of swallows as intermediary hosts, says that he is now in a position to affirm that the method of transmission is exclusively through the excrement of the fleas, or if these be wanting, by the content of the rectum of the fleas, provided that this contains metacyclic trypanosomes. The author cites his own experiments to show that the same is true of the content of the rectum of bugs. Patton has shown that *Leishmania donovani* could pass its life-cycle in bugs, *Cimex lectularius* and *C. rotundatus*. Wenyon and Patton have shown that *Leishmania furunculosa* can also pass its life-cycle in these insects, and it is probable that the failure of these investigators to induce infection was due to the fact that they did not inoculate the dejecta of the infected bugs. So also Mediterranean Kala Azar, though apparently inoculated by the fleas, is probably transmitted by their dejecta, which either enter the digestive tract through licking or by cutaneous contamination. *T. rabinowitschi*, found in the hamster, has been discovered in the flea of that animal, *Typhlopsylla assimilis*, and also in *Ceratophyllus fasciatus* and *Ctenocephalus canis*. The small metacyclic trypanosomes are met with in the rectal ampulla. *T. nabiasi*, which was first found in France in the blood of domestic rabbits, has been found in England and in Sardinia in wild rabbits, and the author discovered it in four rabbits out of 29 at Chantilly. The life-cycle of this trypanosome according to the author is passed entirely in the body of the rabbit flea and it will not develop in the bug (*C. lectularius*). *Trypanosoma blanchardi*, Brumpt, is developed in the flea (*Ceratophyllus laverani*) of a species of dormouse, and the author by cultivating some hundreds of these fleas has been able to follow its development. This trypanosome will not develop in the flea of the swallow or in the bug. *T. duttoni* will, the author says, develop with great ease in the flea of the swallow. In bugs the process is comparable to that occurring in the case of *T. lewisi*. He thinks that mice certainly infect themselves by licking off the dejecta of the fleas when cleaning themselves or by eating fleas, which amounts to the same thing; experiments made by the author with young mice tend to show that this is the case.

Brumpt (E.). **Immunité partielle dans les infections à *Trypanosoma cruzi*, transmission de ce trypanosome par *Cimex rotundatus*. Rôle régulateur des hôtes intermédiaires. Passage à travers la peau.** [Partial immunity in the case of infection by *Trypanosoma cruzi*. Transmission of this Trypanosome by *Cimex rotundatus*. Regulative rôle of intermediary hosts. Passage through the skin.]—*Bull. Soc. Path. Exot.*, vi, no. 3, 12th March 1913, pp. 172-176.

The question which the author set himself to answer was, Can a subject infected in infancy by *T. cruzi* be further infected in adult life by *Conorrhinus*? The first question to be settled was whether virus received from Bahia was identical with that isolated by Chagas. The author was able to obtain a supply of this virus and 19 mice seriously infected in the early days of their life in May 1912 were inoculated, some on the 5th December and others on the 20th of the same month, with large doses of the Chagas virus at the same time with 30 controls of the same age and the same brood. The result was relatively clear. All the controls died between 15th and 25th day and of the 19 mice cured of their Bahia infection, nine are still alive, although after 11 and 13 weeks a few trypanosomes were still to be found in their blood. The ten dead mice exhibited a lengthy incubation of two to four weeks. These experiments proved that the first attack with the Bahia virus confers a considerable resistance to considerable doses of the Chagas virus. The author remarks that this latter virus appears to have acquired a very great virulence for mice. He experimented with two fresh larvae of *Conorrhinus* without result, and obtained no flagellate forms from their excreta. Experiments were further made with hundreds of bugs, *Cimex lectularius* and *C. rotundatus*. Both species are infected to a considerable degree, 80 per cent. on the average, and their dejecta contained metacyclic trypanosomes. The poison obtained was injected into young mice three or four days old whose brothers and sisters served as controls. Results were very curious, the mice were very slightly infected and both they and the controls recovered from the infection in a few days. The metacyclic form of *T. cruzi* has a considerable power of penetration. The dejecta of *Conorrhinus* placed in the mouth or in the rectum of mice or on the nipple, that is to say in places where there were no excoriations, produced certain infections. By placing the dejecta on the skin of four mice, aged two days, then suspending them by thread for three hours in a moist atmosphere and carefully washing them at the end of the experiments, the author succeeded in infecting all. This experiment shows that it is at least possible with trypanosomes to produce infection through the skin, and it is probable that man is infected in this way through the mucous membrane of the mouth, because *Conorrhinus* generally bites the face and lips of sleeping individuals. After feeding, and sometimes before, the dejecta of these insects are abundant and may readily come into contact with the buccal mucous membrane. The author draws special attention to the fact elucidated by his experiments, that the virus loses a large part of its intensity in passing through an intermediate host. Gonder has shown that a race of *T. lewisi* capable of resisting arsenophenylglycine, loses its resistance after passage through the rat louse, *Haematopinus spinulosus*, about the 10th day, and it would appear that passage through an invertebrate host causes it to lose all the physiological characters which laboratory experiments have given it; hence a certain number of these lose their value, and it is necessary that all experiments should be performed with natural virus. The author further remarks that the fact that certain animals are artificially sensible to a virus, does not prove that they can be infected in nature through the intervention of an intermediate host, and gives two typical examples. Red frogs which are very sensible to injections of *Trypanosoma inopinatum* may be bitten by hundreds of infected leeches for several months without receiving infection, whilst the bite of a single one of these leeches sufficed to infect a green frog, the blood of which became virulent to a red frog. It has further been shown that it is possible in the laboratory to parasitise mice with *T. lewisi* of the rat, but this is not so in nature, and the author says that he has searched in vain for trypanosomes in wild mice living in the same places as rats which were commonly found to be parasitised.

THOMSON (Dr. D.). **Sanitation in the Panama Canal Zone, Trinidad, and British Guiana.**—*Ann. Tropical Medicine and Parasitology*, vii, no. 1, 31st March 1913, pp. 125-152, 3 pl.

The author, who was sent on an expedition to study malarial problems by the Liverpool School of Tropical Medicine, has nothing but praise for the thoroughness with which the Americans have converted the Panama Canal Zone from a white man's grave into a district that compares favourably with temperate countries. The anti-mosquito measures carried out under the leadership of Colonel Gorgas, Chief Sanitary Officer, demonstrate that the settling of the tropics by the Caucasian will date from the completion of the Panama Canal. In contrast with the energy displayed by the authorities at Panama, the author remarks on the inadequacy of sanitary measures in Trinidad, owing to the slowness of the authorities in giving either moral or financial support. With regard to anti-yellow-fever work, there are no legal powers to enforce the abolition of eaves gutters, which form permanent breeding grounds for *Stegomyia*. In British Guiana more serious efforts are being made, especially as it is an exceptionally difficult place to deal with, all the sea-coast, including Georgetown, lying below the level of the sea at high water. The amount of material available for filling in breeding places of mosquitos is small. There is not a single mosquito-proof house in Georgetown, but water-barrels and tanks are carefully roofed so that mosquitos cannot breed in them, and the streets are well paved. The majority of the medical men in both colonies are thoroughly alive to all that is required, and it is extraordinary how much they have done unaided. But alone they cannot organise such a system as that in Panama. That is a matter which requires the aid of the community, and Col. Gorgas has stated emphatically that his system has paid financially and that the money required is well within the means of any tropical country.

DUKE (Dr. H. L.). **Some Attempts to transmit *Trypanosoma gambiense* by wild *Stomoxys*: with a Note on the Intestinal Fauna of these Flies.**—*Rep. of the Sleeping Sickness Commission of the Royal Society, London*, no. xiii, 1913, pp. 89-93, 36 figs.

Wild *Stomoxys* (*nigra* and *calcitrans*) were caught on cattle grazing around the foot of Mpumu Hill, Uganda. There had been no epidemic of cattle trypanosomiasis in the immediate neighbourhood of late. The flies were kept under the same laboratory conditions as *Glossina palpalis*, except that care was taken to ensure an extra supply of moisture. The flies dying during the first four days were discarded, as it was presumed from analogy with the behaviour of *T. gambiense* in *G. palpalis*, that any flagellates found in the flies after the first four days would be truly developing forms. In the experiments, the results of which are tabulated, the wild flies were fed first for varying numbers of days on an infected monkey and then placed daily on clean monkeys until the last remaining fly died. None of the monkeys became infected. Although no flagellates having crithidial or trypanosome structure were seen in the flies dissected, two interesting organisms were discovered, one a flagellate showing the structural characters of the Bodos, the other a crescent-shaped body, which may perhaps represent some stage of development of a sarcosporidian.

Balfour (A.). **Animal Trypanosomiasis in the Lado (Western Mongalla) and Notes on Tsetse-fly Traps and on an Alleged Immune Breed of Cattle in Southern Kordofan.**—*Ann. Trop. Med. and Parasitology*, Series T.M., vii, no. 1, 31st March 1913, pp. 113-120, 2 plates.

When the Sudan Government took over the Lado Enclave from the Belgian Congo, it found itself in possession of an area infected with sleeping sickness; but since that time a large amount of work has been done by Captain Thompson and Lieut. Ranken in studying the disease and in combating it both prophylactically and therapeutically, though so far little attention has been paid to the forms of animal trypanosomiasis present in this part of Africa.

In May of 1912 the author visited the sleeping sickness camp at Yei, in Western Mongalla (as the Lado district is now called) and made a number of observations and measurements of trypanosomes with a view to determining the species. He says, as a result of investigations, that if the infection had been derived along the automobile road in Western Mongalla, the carrier was probably *Glossina palpalis*, as *G. morsitans* was not found in this locality, and the only other biting flies are *Haematopota*. He thinks it however very probable that the bulls examined were infected before going to Western Mongalla, and that some species of *Tabanus*, *Chrysops* or *Stomoxys* is the active agent in transmitting this form of animal trypanosomiasis in the Southern Sudan. The author has had a number of tsetse-fly traps constructed by the Andrés Maire Company, one of which is figured, and he suggests the following methods of attracting the flies:—(1) Soaking the central bands or wicks in a mixture of water and either human or animal sweat; (2) placing a live animal in the trap; (3) soaking the central bands in citrated blood, and at the same time hanging up in the trap a piece of fresh meat from an ox or buck with the skin still adherent; (4) soaking the bands as above and having in addition a tube of citrated blood arranged according to the ingenious device of Rodhain and his colleagues; if desired, the blood in this tube may be poisoned.

In a note, the author says that there is a small black breed of cattle found in Southern Kordofan which is said to be immune to trypanosomiasis, and to be the only breed which can live in the infected Koalib area, where *G. morsitans* abounds and conveys an infection due, in the author's opinion, to *T. brucei*. He mentions Dr. Pollard's statement that in the Muri Province of Northern Nigeria there is a small black breed of cattle which is apparently immune to tsetse. At any rate in this district these cattle will live, whereas horses and imported Fulani cattle all die.

Macfie (Dr. J. W. Scott). **Trypanosomiasis of Domestic Animals in Northern Nigeria.**—*Ann. Trop. Med. & Parasitology*, Series T.M., vii, no. 1, 31st March 1913, pp. 1-20, 3 plates.

Trypanosomiasis is very prevalent among domestic animals in Northern Nigeria, and, at any rate in the south-western portions of the Protectorate, causes a heavy mortality and serious financial losses. The author states that it is difficult to give an adequate measure of the loss, but cites the following instances:—In 1912 he was stationed in the province of Ilorin and in eight months ten out of 15 horses owned by Europeans contracted the disease and six died. Ten healthy donkeys were selected for transport purposes, and within three months all had died. At Zungeru 25 horses were treated for the disease and of these 40 per cent. either died, or were so seriously affected that they were sold for practically nothing. Dr. Watson has estimated that at Lokoja the disease is even more serious, and that over 73 per cent. of the horses were killed or incapacitated by tsetse disease. The disease appears to be spreading, and this is proved by the additions made from time to time to the list of localities in which the Government declines to compensate officers for the loss of horses which have died from trypanosomiasis contracted in the discharge of official duties. Losses amongst natives cannot be correctly ascertained, but they must be very great, and their magnitude may be gauged by the experience of the Emirs who attended the Coronation Durbar at Zaria in June 1911, one of whom is said to have lost 70 per cent. of his horses. Europeans who were compelled in the exercise of their duty to visit those tracts of Nigeria which are known to be unsuitable for horses, not only sacrificed their own animals, but on the way home passing through other districts spread the disease in every direction. Besides horses, cattle, and especially goats and dogs, are also affected. In their long trek to the coast, the herds of cattle from the north carry trypanosomiasis with them, maintaining the infection in old localities and introducing it into new. The herdsmen quickly recognise the symptoms of the disease and slaughter the beasts wherever they may happen to be. Ilorin is situated at a point on the main caravan road where the routes from Kano and Sokoto converge, and that the majority of animals slaughtered there for the market were found to be suffering from trypanosomiasis. The author gives tables showing the species of trypanosome found in a large number of animals, and describes the symptoms of the disease in horses, donkeys and cattle.

He summarises the general results of his observations as to the distribution of the various species of trypanosomes as follows:—

1. Trypanosomes presenting the morphological characters of *T. brucei*, *T. vivax*, *T. nanum* or *pecorum*, and *T. theileri* have been found in Northern Nigeria in the blood of domestic animals; *T. brucei* in the horse, donkey, Fulani cattle, dwarf cattle and sheep; *T. vivax* in the horse, donkey, Fulani cattle, sheep, goat and dog; *T. theileri* in the dwarf cattle.

2. *T. vivax* is the most common form, at any rate in the south-western portions of the Protectorate, being present in 55 out of 84 cases collected in Ilorin province, the Niger province and at Lokoja.

3. Of 20 Fulani cattle trekking down towards the coast from the provinces of the north, and found to be suffering from trypanosomiasis, 18 harboured *T. vivax*.

4. In horses *T. vivax* produces a much less serious disease than *T. brucei*. Of 15 cases infected with *T. vivax*, of which the records are complete, 14 recovered. Of 11 cases infected with *T. brucei* none recovered.

5. The dwarf breed of cattle found in certain tsetse-haunted districts of Northern Nigeria, and credited with a natural immunity to trypanosomiasis, while apparently recovering from infections with *T. vivax*, succumb to *T. brucei*.

Christophers (Major S. R.). **Contributions to the Study of Colour-Marking and other Variable Characters of *Anophelinae* with Special Reference to the Systematic and Phylogenetic Grouping of Species.**—*Ann. Trop. Med. & Parasitology*, vii. no. 1, 31st March 1913, pp. 45-100, 4 plates.

An interesting discussion, accompanied by a useful tabular summary and illustrations, of the variation in colour-markings in Anophelinae, variation in structure other than that connected with scales, structural variation in the immature stages, variation as displayed by scales, and of the classification, phylogeny and geographical distribution of these mosquitos. Major Christophers is of opinion that, with some slight re-arrangement, practically all the Anopheline genera proposed by Theobald should stand. He considers that colour-markings, and general characters as a whole, seem to point to there being a group of more primitive forms (Protoanopheles), represented in the Old World by *Anopheles*, *Myzorhynchus* and *Patagiamyia*, and in the New World by *Cycloleppteron*, *Arribalzagia* and *Myzorhynchella*. There is also a distinct group corresponding to Dönitz's Australasian species with more than three spots on the sixth vein (Neoanopheles). Their area of special prevalence is Australasia and Malaya. The majority of Anophelines belong to a group the colour-markings of which are all on a given scheme (DEUTEROANOPHELES). This group shows two main divisions, characterised by a notable difference in the intensity of their coloration and the 'effectiveness' of ornamentation, possibly arising from two different lines of evolution. Their area of special prevalence includes Africa, South Asia and Malaya. The most widely distributed of the genera of this group is *Cellia* and this fact harmonises with its phylogenetic position. *Pyretophorus*, in the restricted sense in which the author uses the term, is dominant in N. Africa, S. Europe and N.W. India. It does not occur in S. America or Australia, and it is scarcely represented in India and Malaya. *Myzomyia* and *Nyssorhynchus* are African, Malayan and Indian, *Nyssorhynchus* distinctly dominating in the two latter areas.

MITZMAIN (M. B.). **The Bionomics of *Stomoxys calcitrans*, Linnaeus; a preliminary account.**—*Philippine Jl. of Science*, viii. B, no. 1, February 1913, pp. 29-48, 4 tables.

The author had unusual opportunities for studying the bionomics of *Stomoxys calcitrans* in connection with a large number of experiments on the transmission of surra, in which thousands of flies of this species were captured or bred. [See this *Review*, ser. B, p. 113.] This paper is to be considered as supplementary to Newstead's treatise (Ann. Trop. Med. & Parasit., 1907, pp. 82-96). Under normal conditions the eggs of *S. calcitrans* are laid in the faeces of its host and have been found in those of the horse, carabao, bullock and other domesticated animals, as well as the guinea-pig. The age at which *S. calcitrans* begins to lay eggs has been determined in bred flies to be nine days. The maximum number of eggs produced by a single female may be stated as at least 632 and possibly 820. As many as 20 depositions may be made in the life-time of a female. The incubation period for these eggs is from 20 to 26 hours at a temperature of from 30° to 31° C. The larval stage under optimum conditions is usually from seven to eight days, and the young larva loses no time in consuming whatever desirable food may be present, the mother laying the eggs only where there is an abundant food supply. When confined in a test-tube the maggots will invariably remove the moisture from each other's bodies and later on eat parts of the latter. Injured larvae become an easy prey to their fellows. The imago emerges from the puparium after five days, but under laboratory conditions this period may be extended to from 6 to 12 days. In more than 40 instances recorded, first emergences were marked by the appearance of males, the male fly usually preceding the female by two days. The sexes are readily distinguished upon emergence, the female being invariably the larger and the lighter in colour. The fly of either sex takes its initial bite in from 6 to 8 hours after emergence. *Stomoxys* was fed experimentally on 17 species of vertebrates, including mammals, reptiles and birds. It is essentially a blood-feeder and has never been observed to take plant juices, but it sips water when confined in tubes. Under conditions obtaining in the Philippine Islands, the fly will feed readily on man, especially after the atmosphere has been cooled by a shower, but it rarely attacks him in the presence of domesticated animals, nor yet to the same extent as in temperate climates. Sick animals are more susceptible to the attacks of *Stomoxys* than are healthy ones.

A peculiar feeding relation exists between *Stomoxys* and certain non-biting flies. The author observed that flies on a bullock were grouped in twos, threes, fours or fives; on closer inspection the group was found almost invariably to consist of more than one species, a *Stomoxys* usually being the central figure. While the latter was feeding, the other flies, frequently belonging to species without a piercing mouth (*e.g.*, house-flies), would give evidence of great impatience and make efforts to dislodge the *Stomoxys*. When the latter was satisfied, the others collected round the puncture and lapped the blood as it oozed from the wound. Cattle are most subjected to bites of *Stomoxys* between 5 and 8 a.m., the flies then remaining sluggish until the heat of the day has subsided, and after a second engorgement resting until the following morning. The life of *Stomoxys* was determined to be at least 72 days for the female and 94 days for the male.

An account is also given of the methods employed in keeping and feeding flies for laboratory purposes, and tables illustrate the life-history of *S. calcitrans* at various periods and under various conditions.

Basile (Dr. C.). **La trasmissione sperimentale delle Leishmaniosi del Mediterraneo ai topi per mezzo delle pulci.** [The experimental transmission of Mediterranean Leishmaniasis to mice by means of fleas.]—*Atti R. Accad. dei Lincei, Roma*, xxii, no. 7, 6th April 1913, pp. 468-470.

In 1910 the author was able to incriminate the flea as the transmitting host of the Mediterranean human and canine leishmaniasis, and in the following year to trace out the development of *Leishmania* in *Ctenocephalus serraticeps canis*. At Bordonaro (Messina), an endemic centre of leishmaniasis, only four out of every thousand *C. serraticeps* and *Pulex irritans* collected in the feather-beds and mattresses of infected children and on dogs living with the latter, were found to have protozoa of the *Leishmania* type in the intestine. About 200 fleas were collected from a dog badly infected with leishmaniasis, kept at a temperature of 22° C., and fed the day after on new-born pups. Only three of the fleas showed any protozoa of the *Leishmania* type in their faeces, two of them being very virulently infected, and from these an emulsion in sterile physiological solution at 22° C. was made. Two white mice (*Mus musculus*) were subsequently inoculated with this emulsion and an examination of the medulla of their tibiae failed to reveal any parasites. On the 56th day after inoculation one of the mice was killed, and smears of the liver and spleen immediately revealed the presence of *Leishmania* of a type identical with that found in the fleas and in the dog upon which they were feeding.

Alcock (Col. A.) & Summers (Miss S. L. M.). **Remarks on the Systematic Position of *Anopheles sinensis*, Wiedemann.**—*Jl. Lond. Schl. Trop. Med.*, ii, pt. 2, April 1913, pp. 101-104.

The authors object to the subdivision of the genus *Anopheles* and its elevation to the status of a subfamily, because, in their opinion, the genus exhibits a long series of slight gradations represented at one end by *Anopheles maculipennis* and at the other by a form such as *A. pulcherrimus* (*Cellia pulcherrima*). They are of opinion that only four species of the subgenus *Myzorhynchus* are entitled to recognition namely:—*Anopheles sinensis*, Wied., *A. mauritianus*, Grp., *A. barbirostris*, Wulp., and *A. umbrosus*, Theo.

Summers (Miss S. L. M.). **A Synopsis of the Genus *Phlebotomus*.**—*Jl. Lond. Schl. Trop. Med.*, ii, pt. 2, April 1913, pp. 104-116.

In this article, which is strictly systematic, the author divides the known species of *Phlebotomus* by continents, giving the salient characteristics of each species. The total number of species recorded is 20, distributed as follows:—Europe 4, Asia 9, Africa 5, America 6.

Wenyon (C. M.). **Experiments on the Transmission of *Trypanosoma lewisi* by means of Fleas.**—*Jl. Lond. Schl. Trop Med.*, ii, pt. 2, April 1913, pp. 119-123.

The author describes experiments which he has made upon fleas fixed on wires by Nöller's method These were first fed on himself, in order to determine by examination of the excrement that they were uninfected, then upon an infected rat, and subsequently again upon the author himself, until the characteristic small infective trypanosomes of Swellengrebel and Strickland had appeared in the faeces. The general result of the experiment was to show that the common rat flea of India, *Xenopsylla cheopis*, is a true host of *Trypanosoma lewisi*; and the author is of opinion that another important point results from the experiment, namely, that it can be no longer held that a difference in invertebrate host necessarily means a difference in species of trypanosome. The fact that in one locality a trypanosome is transmitted by a certain fly, whilst in another locality a similar trypanosome is transmitted by a fly belonging to a different genus is not a proof that the trypanosomes are different. If, however, it could be shown that the trypanosome in one locality was incapable of development in the fly of the other locality, then it could be fairly assumed that the trypanosomes were really distinct. Such a test could, with profit, be applied to the two human trypanosomes, *T. gambiense* and *T. rhodesiense.* The former, will develop both in *Glossina morsitans* and *G. palpalis*, whilst the latter has only been shown to develop in *G. morsitans*. Could it be shown that *T. rhodesiense* is incapable of development in *G. palpalis* a further strong argument in favour of the distinction of the two species of human trypanosome would be obtained.

KING (H. H.). **Notes on the Bionomics of the Sandflies (*Phlebotomus* spp.) of Tokar, Anglo-Egyptian Sudan.**—*Bull. Entom. Research,* iv, pt. 1, May 1913, pp. 83-84.

The cultivated area around Tokar, which comprises 30,000 to 40,000 acres of cotton, is notorious throughout the Sudan for the number and bloodthirstiness of its sandflies. The adults can be found in numbers at least two miles away from any mud or brick wall or building. They are equally numerous on clean land growing cotton and on land on which cotton has failed and which therefore supports only a few grasses and other weeds. The officials of the district, who know it well, say that the flies are confined to the flooded area and are not met with in the surrounding desert. Natives living in the town reported to the author that they were not troubled by them, but that a night spent in the cultivations would prove their existence in large numbers. The land on which the town is built is not flooded, being protected by a low embankment of soil. The chief difference between the flooded and the unflooded land is the presence of deep cracks which appear in the former as soon as it begins to dry out. Newstead states (Ann. Trop. Med. Paras. V., August 1911, p. 141) that all the sandfly larvae and pupae taken by Marett and himself in Malta were found living under similar conditions as regards (*a*) presence of organic matter; (*b*) presence of moisture, but not in excess; and (*c*) absence of light. The only situations where these three conditions could be found together at Tokar were in the soil itself, and on flooded land the cracks provided the sandfly with an easy means of access, to such situations. He searched for larvae and pupae in the soil at a place 1¾ miles from the nearest mud or brick building or wall. Here adult sandflies exist in myriads and numbers could be found, sometimes as many as 15, under clods of earth. Only a single larva was found at a depth of about 4 inches in the vicinity of a crack, and when alive closely resembled the soil in colour.

SHIRCORE (Dr. J. O.). **On Two Varieties of *Glossina morsitans* from Nyasaland.** —*Bull. Entom. Research,* iv, pt. 1, May 1913, p. 89.

The author describes two marked colour varieties of this *Glossina* from Nyasaland, one he proposes to call *pallida* and the other *paradoxa*.

NOTICES.

The Review of Applied Entomology is intended to contain, month by month, abstracts of the latest information published concerning insects injurious to man or animals, as the carriers of disease; and to forests, fruit trees, crops or stored merchandise.

The Editor will be glad to receive prompt information of the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion, the adoption of which would increase the usefulness of the Review.

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COOPER (W. F.) & LAWS (H. E.). **The Tick-killing Properties of Sodium Arsenate.**—*Agric. Jl. of the Union of South Africa*, v, no. 5, May 1913, pp. 716-721.

Experiments by A. V. Fuller and others have established without doubt that sodium arsenite becomes oxidised to sodium arsenate in a cattle-dipping bath, but the precise conditions which influence the rate of oxidation are not yet known. At present it is customary to consider sodium arsenite as the only tick-killing agent, and to regard the arsenate as useless. This conclusion appears to be erroneous, because, in the first place, the tick-killing value of a dip is not always proportionate to its arsenical content; and secondly, sodium arsenate has, according to special experiments by the authors, about 40 to 50 per cent. of the tick-killing effect of the arsenite. The arsenate, therefore, certainly is a factor to be reckoned with, and the only true test of the activity of a dip is to test it on tick-infested cattle, when it will be found that even those dips which contain exactly the same quantity of sodium arsenite as well as arsenate are not all equally effective.

The Mahambanendhlwana.—*Agric. Jl. of the Union of South Africa*, v, no. 5, May 1913, p. 788.

In reply to a correspondent the Assistant Chief of the Division of Entomology (Mr. C. Fuller) states that the aboriginal story, generally accepted by Boer and British farmers, that cattle feeding upon veld-inhabiting bag-worms or basket-worms (Zulu, Mahambanendhlwana) [larvae of moths of the family PSYCHIDAE] die from their poisonous effects is unsupported by facts. Twenty to thirty of these insects were experimentally fed to an ox without any ill effects.

NIELSEN (Dr. J. C.). **On some South American Species of the Genus *Mydaea*, Parasitic on Birds.**—*Vidensk. Meddel. fra Dansk naturh. Foren.*, lxv, 26th May 1913, pp. 251-256, 4 figs.

In 1911 the author recorded a fly, *Mydaea anomala*, Jaenn., from Concepcion, Argentina, the larvae of which develop as subcutaneous parasites in tumors on various birds (*Spermophila gutturalis, Mimus modulator, Homorus lophotes, Pitangus sulfuratus bolivianus*). Last year (1912) he received flies, puparia and third stage larvae of another species of *Mydaea* which is parasitic on *Xiphocolaptes albicollis* in Argentina. This species proves to be the true *M. anomala*, and the fly described in 1911 is a new species which Dr. Nielsen proposes to name *M. torquens*.

BRUCE (Sir D.), HARVEY (Major D.), HAMERTON (Major A. E.), & Lady BRUCE. **Infectivity of *Glossina morsitans* in Nyasaland.**—*Proc. Roy. Soc., London*, B. lxxxvi, no. B. 589, 12th June 1913, pp. 422-426, 4 tables.

The authors, after experimenting with more than 10,000 tsetse-flies (*Glossina morsitans*) caught in the 'proclaimed area' of

Nyasaland, come to the following conclusions:—The flies caught near Kasu are infected with four species of pathogenic trypanosomes—*T. brucei* vel *rhodiense*, *T. pecorum*, *T. simiae* and *T. caprae*, the proportion of infected flies being 13·5 per 1,000. The proportion of flies infected with *T. brucei* vel *rhodesiense*, the cause of human trypanosomiasis in Nyasaland, is 2 per 1,000. The flies are infective all the year round and it is suggested that to prevent the infection of tsetse-flies the experiment should be tried of destroying all the wild game in the 'proclaimed area' of Nyasaland.

Franchini (G.). **Sur un protozoaire nouveau parasite de** *Anopheles maculipennis*. [On a new parasitic protozoon of *Anopheles maculipennis*.]—*C.R. hebd. Soc. de Biol., Paris*, lxxiv, no. 21, 13th June 1913, pp. 1196-1198, 18 figs.

In the course of recent research work the author had occasion to make numerous smears of *Culex* and *Anopheles*, and found a protozoon parasitic in the alimentary tract of *A. maculipennis*. This parasite, *Baccellia anophelis*, g.n., sp. n., has nothing in common with any of the flagellates or Sporozoa hitherto met with in Culicids, and its entire life-cycle seems to take place in the alimentary canal of its host.

Laveran (A.) & Franchini (G.). *Trypanosoma talpae* **chez** *Palaeopsylla gracilis*.—*C. R. hebd. Soc. de Biol., Paris*, lxxiv, no. 22, 20th June 1913, pp. 1254-1256, 11 figs.

An examination of fleas, all belonging to the species *Palaeopsylla gracilis*, found on moles, showed that a quarter of them were infected with *Trypanosoma talpae*, and these flagellates appearing in large and small forms resemble *T. lewisi* in the rat flea.

Portchinsky (J. A.). **ОВЕЧІЙ ОВОДЪ ЕГО ЖИЗНЬ, СВОЙСТВА, СПОСОБЫ БОРЬБЫ И ОТНОШЕНІЕ ЕГО КЪ ЧЕЛОВѢКУ.** [*Oestrus ovis*, L.: its life-history and habits, the methods of combating it and its relation to human beings.] **ТРУДЫ БЮРО ПО ЭНТОМОЛОГІЙ** Ученаго Комитета Главнаго Управленія Землеустройства и Земледѣлія [Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture] x, no. 3, 63 pp. 28 figs. St. Petersburg, 1913.

In the first part of his paper the author deals with various cases in which human beings have been infested with the larvae of *Oestrus ovis*. In 1911 he received specimens of parasites taken by Dr. Farmakovsky from the eyes of a patient in the district of Samara, and he was able to satisfy himself that they were actually the first-stage larvae of this fly. A number of similar records are cited which Dr. Portchinsky thinks are probably referable to the same species, and he quotes at some length the statements of the brothers Sergent (Ann. Inst. Pasteur, 1907, pp. 392-399) to the effect that in Algeria this *Oestrus* lays its eggs in the noses, eyes or mouths of human beings in those parts of the country where sheep are scarce. But man is not a true host for these insects and the larvae fail to develop, the inflammation caused by them usually disappearing in from 3 to 10 days.

A full description is given of the anatomy of the fly, and it is contended that the rudimentary character of the proboscis and digestive tract sufficiently indicate that no food is taken by the adult insects, contrary to the opinion of Collinge, who states that they feed on the nectar of flowers (Rept. Injur. Ins., 1904, p. 53).

Dr. Portchinsky also finds some difficulty in understanding the statements of Theobald and Collinge to the effect that *Oestrus ovis* sometimes deposits, not larvae, but eggs round the noses of sheep (Jl. Econ. Biol., i, p. 72), as this is quite contrary to what is known of the habits of the fly in Russia, nor, in his experience, would sheep permit the insect to settle on their heads. He can only suggest that these are anomalous cases, due to some diseased condition of the fly.

The insect is most active during the hot hours of the day, and is very sensitive to a fall in temperature; in the early morning and evening, and also during wet or windy weather, it hides in holes in walls or similar places.

A detailed account is given of the first larval stage, which has not been previously described, for, according to the author, Collinge's description applies to the third stage only. The first stage closely resembles that of *Rhinoestrus purpureus*, Br., but no anal papillae are present. When it has penetrated into the frontal sinuses, the cavities of the ethmoid bone, or those of the horn or jaw, the larva loses all its bristles and hooks and becomes transformed into its second stage, which appears to be one of rest; in this condition it passes the autumn and winter with but little change. During the spring and early summer the larva passes into its third and last stage, which is fully described. It is principally in this stage that the larvae cause in sheep the fits which are known as "false gid."

The usual number of larvae found in the sinuses is from 1 to 8, but sometimes there are from 20 to 40, and Zurn states that he has even found 60 to 80 larvae. When full-grown, the larva drops from the nostril of the sheep, and after seeking cover pupates in about 24 hours. The pupal stage lasts for 25 to 50 days.

The author describes the manner in which sheep try to evade the attacks of *Oestrus*, their behaviour before and after infection, and the pathological symptoms caused by the larvae in their various stages.

In the south of Russia *Oestrus ovis* first appears in the second half of May and continues on the wing until August or even September. In 14 females which the author dissected on the 17th October in southern Russia he found eggs in various stages of development and in some cases even larvae. It is practically certain that these insects would have been killed by cold before reproduction was possible.

Oestrus ovis caused great epidemics in sheep in Russia in the years 1848, 1849, 1854 and 1868. In recent years the disease has spread considerably, especially in the northern districts of the Goverment of Taurida, where in some herds the number of infected sheep suffering from fits in 1907 reached 10 per cent. The observations of the author in some Governments of south and south-east Russia (Bessarabia, Astrakhan) prove that these outbreaks are in some places quite a normal state of things and that in the spring or at the beginning of summer, if the heads of sheep which have been killed be opened, larvae of *Oestrus ovis* can always be found. The author also gives some figures relating to other countries.

The last part of the paper is devoted to the question of remedies against this pest. The author describes some of the older methods that used to be in vogue, such as burning the steppes twice a year, administering powders to the sheep to produce sneezing, &c., and explains their futility. Remedies intended to destroy the larvae in the sinuses, such as injections of lime water, alcohol, dilute naphtha, weak solutions of carbolic acid, &c., are also, in his opinion, quite useless, only causing the larvae to creep deeper into the different cavities. Surgical operations, such as trepanning, are also ineffective. In the opinion of Zurn, quoted by the author, these operations and also the cutting away of the horns, do not relieve the sheep. Zurn during the past year has performed a great number of such operations and afterwards injected different medicaments, but such good results as were obtained were only temporary, and after a short time the illness returned, sometimes with even greater force. One of the latest remedies, used both in England (Collinge) and America (Riley, Osborn), aims at keeping away the female insects by smearing the nose and lips of the sheep with birch-tar, but in the opinion of the author this method is also quite useless, as the insect will always be able eventually to accomplish its aim; and quite apart from this, it never really touches the nostrils of the sheep when depositing its larvae, but ejects a drop of liquid containing the larvae into the nostrils as it flies rapidly past them.

In the opinion of the author there is only one way of fighting this pest which is effective and at the same time quite simple. Instead of fighting the larvae, all methods for which are either quite useless or actually harmful, attention should be directed towards the destruction of the adult insect. Further it is only necessary to capture those females which are on the wing during the spring or summer, as the later generation will perish without being able to deposit larvae. The method recommended by the author can be best applied on the extensive open steppes, on which in Russia sheep breeding is mostly practised, and is based upon the characteristic habit of the insect of sitting motionless, during the morning and evening or during bad weather, on any raised object, such as a wall or fence, that may be available. If such a resting place is present, one can assume with certainty that nearly every *Oestrus ovis* in the locality will visit it once or several times during its life; and if examined at suitable times the insects can be caught with little difficulty. The author, therefore, recommends the erection, on stretches of open country, of one or more wooden screens, made preferably from old, darkened boards with an uneven surface, as these would be more attractive to the insects. These screens must be so placed that one side should be turned to the south or south-west, at the same time protecting the gadflies from the prevailing winds of the district. It is preferable to make them portable. During the morning, before it becomes hot, the shepherds can easily catch the flies with their hands, tearing off one wing, or the head, and putting them into a bottle, so that they can be counted later. If there are sheepfolds in these places their walls must also be examined. The author recommends encouraging the destruction of the insects in this way by offering a small reward ($\frac{3}{4}d.$ or $\frac{1}{2}d.$) for each fly.

MACFIE (Dr. J. W. Scott). **The Distribution of *Glossina* in the Ilorin Province of Northern Nigeria.**—*Bull. Entom. Research*, iv, pt. 1, May 1913, pp. 1-28, 7 pls., 1 map, 5 figs.

The author says that in Northern Nigeria the foci of sleeping sickness are at present peculiarly isolated, but that the disease may possibly spread with the opening up of the country and the consequent increased facilities for intercommunication. It is said to be endemic in the neighbouring province of Kabba and might readily move westwards into Ilorin, in a large part of which tsetse-flies already spread disease amongst the cattle and horses to such an extent that these animals cannot live. Nevertheless during the dry season herds of cattle pass, day after day, in an almost continuous stream along the high-roads on their way to Lagos from the north, though many of them die on the road.

The various divisions of the province and their characteristics are described, and tables of temperature and rainfall are given. Collections were obtained from more than 500 different localities and the species of *Glossina* noted were *G. palpalis*, *G. tachinoides*, *G. morsitans* and *G. longipalpalis*. Generally speaking *G. palpalis* and *G. tachinoides* occur in all districts. *G. morsitans* was curiously restricted to the eastern division. No flies of this species were taken to the west of a line corresponding roughly with the fifth degree of longitude, and none was found further south than Egbe and Offa Ora. Each division is treated separately with regard to the distribution of the flies, and at the end of the paper is a complete synopsis of the localities in which flies were taken. An example is given of the good effect of destroying a patch of marsh near the town of Offa, which was a haunt of *G. palpalis*. The flies were previously very numerous about this marsh, but after it had been cleared and drained, diligent search in July, August and September, that is during the height of the rains, failed to reveal any tsetses and the European residents informed the author that they had not observed any in their offices or bungalows.

A table is given showing the distribution of Fulani cattle in the province, which is interesting as indicating the districts and localities in which native experience has taught that cattle may be safely grazed. On comparing the map which represents the distribution of cattle, with another map showing the distribution of tsetse-flies, it is seen that the districts in which cattle are absent are, with the exception of those in the south-western corner, almost co-extensive with the districts in which *G. morsitans* has been found. The correspondence is so close that it suggests that the presence of the insect is the reason why cattle cannot live in these districts. Fulani cattle, however, live and breed, apparently in perfect health, in districts in which *G. palpalis* and *G. tachinoides* are widely distributed, and it is an everyday occurrence to see herds of cattle grazing beside the streams at the very spots where these tsetses have been found to be most common. A few dwarf cattle are met with in the southern and south-western districts, and there is some reason to suppose that these animals, even when living in country haunted by *G. submorsitans*, may escape the attacks of these insects, as collections of biting flies made at the spots where they were actually grazing did not include this species, although specimens of both *G. palpalis* and *G. tachinoides* were taken.

With regard to the apparent absence of human trypanosomiasis the author says that the comparative scarcity of game must be taken into consideration, but there is some reason to believe that the native population is less susceptible to the disease in West Africa than in other parts of the Continent. Nevertheless the opening up of the country is accompanied by the introduction of individuals, both Europeans and natives, who are certainly not immune. Trypanosomiasis in domestic animals is exceedingly common and the loss on this account is very great. Dr. Macfie points out the practical difficulty of clearing the country of tsetse, which he regards as impossible, and he thinks that stock could be raised in those areas where *G. palpalis* and *G. tachinoides* are not too numerous and are localised in definite haunts. He advocates the clearing of all undergrowth round the villages and towns, and the construction of a number of similarly cleared roads and tracks from this centre towards the farm lands and grazing grounds. Similar clearing should be made for some distance on either side of the local water supply, and at the points to which the cattle are led to drink. It might, in some cases, be possible to institute village grazing grounds, suitably enclosed, and with access to a cleared portion of a stream, in which the small domestic animals might be confined. The site of these plots would have to be changed from time to time, but the land thus fertilised would be valuable for agricultural purposes, and additions would be made in this way automatically to the cleared areas around the villages. Natives should be encouraged to farm the road-sides, as cultivation has proved to be the most effective way of exterminating tsetse-flies. This would afford protection to local cattle moving from pasture to pasture and would tend to diminish the spread of infection carried by herds passing through the province on their way to the coast. The most natural course would be to examine herds on their arrival in the province at the four points at which they cross the Niger, and to slaughter or detain all those likely to cause the spread of infection; but the provision of a staff of trained microscopists and the fact that animals are often highly infectious before exhibiting any external symptoms, consitute practical difficulties which render such a course almost impossible of adoption. Camps should also be established near every large town and European station in which sick horses, donkeys and other animals that it is inadvisable to slaughter might be isolated. The author thinks that in view of the discoveries of Kinghorn and Yorke in Rhodesia, the destruction of big game in the vicinity of inhabited centres should be encouraged instead of being artificially restricted.

THEILER (Dr. A.). **The Immunisation of Cattle against East Coast Fever.**—*Second Rept. of the Director of Veterinary Research, Union of South Africa, Oct.* 1912, *Cape Town*, 1913, pp. 266-314.

Since dipping against ticks could not be resorted to, some 133,833 cattle in the Transkei have been inoculated with spleen and gland pulp mixed with peptone or aleuronat. The experience in the field indicates that the inoculation can be undertaken safely in respect of either clean or infected cattle with the prospect of conferring immunity on 56-60 per cent. The immunity may not be absolute as 1 per cent. breakdowns were noted amongst the experimental animals. The animal which supplied the spleen and gland pulp for the injection has apparently an influence on the results, as the variation in mortality from the injection cannot be considered to be due to any other factor.

BEDFORD (G. A. H.). **A Tick New to South Africa.**—*Second Rept. of the Director of Veterinary Research, Union of South Africa, Oct.* 1912, *Cape Town*, 1913, pp. 343-344, 1 pl.

Spinose ear-ticks (*Ornithodorus megnini*, Dugès) were found in the ears of cows at Vryburg, and sheep at Fauresmith. They have also been found in the ears of the horse, ass, dog, and occasionally man, in the Sudan, United States and Mexico. They can be easily distinguished from all other species of *Ornithodorus* in South Africa by the integument not being mammilated. According to Hooker the larvae hatch out after 11 days in summer; they then enter the ears of the host and gorge themselves; after five days they moult upon the host, and the nymphs continue feeding sometimes for months. They then drop off, and crawl up several feet from the ground and secrete themselves in cracks and crevices of posts, gates, etc., where they change to adults after about seven days. They then pair and the females commence ovipositing, after which they die. It is not necessary for the adults to nourish themselves before copulating and ovipositing, as they are able to store up enough food in the nymph stage. The author agrees with Hooker in believing that the adults never feed, because they have never been found on a host, and as the hypostome is unarmed, and the capitulum very small they are most probably unable to feed. He put some adults in the ear of a calf, but they all died within five days.

THEOBALD (F. V.). **Second Report on the Mosquitos of the Transvaal.** —*Second Rept. of the Director of Veterinary Research, Union of South Africa, Oct.* 1912. *Cape Town*, 1913, pp. 315-342, 2 pls.

The report is based mainly on a large collection of mosquitos from Onderstepoort. Three new species are recorded, viz., *Pseudohowardina lineata*, *Grabhamia caballa* and *Uranotaenia nivipous;* also two new varieties, one of *Culex salisburiensis* and the other of *Culex theileri*. Three species previously unrecorded in the Transvaal occur in the collection, *Culex cumminsii*, *C. guiarti* and *Chrysoconops fuscopennatus*. The insect previously recorded by the author as *Taeniorhynchus tenax* var. *maculipes* is undoubtedly the same as *Culex quasigelidus*, Theo. The generic name *Mansonia* used in the previous report has to sink as a synonym of *Taeniorhynchus*, Arr., and the author proposes the name *Pseudotaeniorhynchus* for the species which he has previously called *Taeniorhynchus*. The author criticises various changes in nomenclature suggested by Mr. F. W. Edwards.

RODHAIN (J.), PONS (C.), VAN DEN BRANDEN (F.) & BEQUAERT (J.). *Leptomonas* **d'Asilides et Trypanosomides intestinaux de Réduves et d'Hemiptères phytophages au Katanga.** [*Leptomonas* in Asilids, and intestinal trypanosomes of Reduviids and phytophagous Hemiptera in Katanga.]—*Revue Zool. Africaine, Bruxelles*, ii, no. 3, 30th May 1913, pp. 291-301, 7 figs.

The members of the Katanga Scientific Mission have previously (Bull. Soc. Pathol. exotique, iv, 1912, p. 528) described some trypanosomes from the intestines of an Asilid and of two Reduviids, which latter have since been identified by Schouteden as belonging to the same species *Rhinocoris albopilosus*. Sign. In the present paper the results are amplified and illustrations of the parasites given, the authors using *Leptomonas* as a term synonymous with *Herpetomonas* of British investigators. The method by which *Asilus* are infected is not yet clearly understood. These voracious Diptera prey upon other insects which they catch on the wing, and in spite of feeding them in the laboratory on *Pycnosoma*, *Sarcophaga* and *Glossina*, no trypanosomes developed in the intestine of the Asilids. The question of Reduviids being infested by trypanosomes assumed great importance since Chagas showed that the flagellates found in the intestine of *Conorrhinus megistus* were a stage in the cycle of a pathogenic trypanosome; and, more recently Lafont discovered that the parasites of *Conorrhinus rubrofasciatus* were capable of infecting the rat. In the course of their investigations the members of the Katanga Mission were unable to find blood-sucking Reduviids, although their attention had been directed towards these insects; but they discovered a very large number of these Hemiptera sucking the lymph of other insects. At Bukama and Sankisia the intestines of 84 Reduviids (16 larvae and 68 adults) were examined for trypanosomes. The species examined were *Rhinocoris albopilosus*, *R. bicolor*, *R. venustus*, *R. segmentarius*, *Hediocoris imitans*, *Acanthaspis sulcipes* and *Cosmolestes pictus*. Not a single larva was found to be infected, and among the adults only two species *R. albopilosus* and *C. pictus* were parasitised. At Sankisia the authors found that 5 per cent. of *Gerris fossarum*, a water-bug, were parasitised by a trypanosome of the identical species described by Patton from the same insect in India. Among ten different species of phytophagous Hemiptera examined, six were parasitised by *Leptomonas*: *Serinetha fraterna; S. amicta; Cletus bisbipunctatus; C. lituripennis; Mirperus jaculus* and *Oncopeltus famelicus*. A Pyrrhocorid captured near Sankisia was parasitised by flagellates of the genus *Crithidia*.

Bequaert (Dr. J.). **Tabanides recueillis au Congo Belge par la mission pour l'étude de la maladie du sommeil. ii. Tabaninae.** [Tabanidae collected in the Belgian Congo by the commission for the study of sleeping sickness. ii. Tabaninae.]—*Rev. Zool. Africaine, Bruxelles*, ii, no. 3, 30th May 1913, pp. 449-467, 16 figs.

An account of 36 species of the genus *Tabanus* and eight species of *Haematopota* from the Belgian Congo.

Loughman (Capt. W. F. M.). **Phlebotomus in Aden.**—*Jl. Royal Army Med. Corps*, xxi, no. 1, July 1913, p. 92.

An undetermined species of *Phlebotomus* has been discovered in Aden in small numbers. The first specimen was captured in March last. Between February and 26th May, three cases of sandfly fever came under the author's observation.

Mould (Lt.-Col. W. T.). **A Table Meat-Safe.**—*Jl. Royal Army Med. Corps*, xxi, no. 1, July 1913, pp. 84-85, 2 figs.

The importance of preventing the access of flies to food is well recognised, and all that is possible by screening cook-houses is being done in India, with partial success. Food in various stages of preparation has necessarily to stand about in a kitchen, and one very frequently sees it covered with flies. To prevent this the author recommends the use of a permanent form of table-cover. It consists of a wooden frame filled in with a fine-meshed wire gauze, the bottom of the frame having a flange all round which overlaps the edge of the table. There are handles at each end for convenience in lifting it on and off, and by its careful use flies are kept away from food. The cost of a safe in use at the Station Hospital, Fyzabad, was Rs. 9/4 (12*s*. 4*d*.).

BRAIN (C. K.). *Stomoxys calcitrans*, Linn. Pt. 2.—*Annals Entom. Soc. Amer., Columbus, Ohio*, vi, pp. 197-203, 1 pl.

The first part of this paper, dealing with the external mouthparts and the digestive system, appeared in vol. v, pp. 421-430 of the same journal. [This Review, B., I, p. 22.] In the second part the circulatory, nervous and reproductive systems are discussed. The paper concludes with observations on the habitat of *Stomoxys* and with a short summary of its life-cycle.

ADIE (Lt.-Col. & Mrs.). **Note of an Inquiry into Malaria and Mosquitos in the Kashmir Valley.**—*Proc. 3rd Meeting Gen. Malaria Committee, Madras, 18th-20th Nov.* 1912, *Simla*, 1913, pp. 91-94.

For a period of six months from 24th April to 26th October only two Anophelines (*A. barianensis*) were met with in the Nasim Bagh (on the Dal Lake) after a diligent search. Larvae of *A. willmori* were captured in a ditch by the side of a rice-field in the Sind valley about four miles up from Ganderbal on 24th and 25th August. As to Culicines, in late April no larvae were seen; in early May, a few in borrow-pits along the Baramulla road: none in the Dal. In the middle of May they became more numerous, but still none in the Dal, and yet when on the lake, the authors were persistently attacked by adults which were eventually found to be breeding in the hamlets on the shores. In the end of May the larvae were found in the Dal Lake, which also contained myriads of *Chironomus* larvae. At Ganderbal during July and August, Culicines were found everywhere, also at Shadipore, but no *Stegomyia*, and no malaria was met with. The Kulu and Kangra valley are rich in Anophelines and have an endemic malaria index of about four. In Srinagar and its neighbourhood there is no endemic malaria, and practically no Anophelines. There is a certain amount of imported malaria with sexual parasites in the blood: but the danger of the disease spreading must be extremely small, as local conditions are adverse to Anophelines, and the possibility of an epidemic is remote on account of the robust physique of the inhabitants.

Report on the Work of the Central Malaria Bureau, 1911-1912.—*Proc. 3rd Meeting Gen. Malaria Comm., Madras, 18th-20th Nov.* 1912, *Simla*, 1913, pp. 51-52.

The Central Malaria Bureau has obtained a complete set of all the known Indian *Anopheles*, and is distributing duplicate sets among public institutions. A point was made during the year of collecting and identifying fish which are known larvae-feeders, the following species being added to the collection of the Bureau: *Haplochilus panchax*, *H. lineatus*, *Basbora daniconius*, *Ambasis ranga*, *Anabas scandens*, *Ophiocephalus punctata*, and *Danio cyprinides*. The duckweeds, *Lemna minor* and *gibba*, *Woolfia* and *Asolla* have been found, when growing in a thick layer on the surface of pools, to be a hindrance to the growth of larvae.

Of the commoner known carriers of malaria *Anopheles culicifacies* was received from: Amritsar, Delhi, Atari, Ferozepore, Kalka; Abbottabad, Tall, Quetta, Kacha; Balaghat; Bombay, Jeypore. *A. stephensi* from: Amritsar, Delhi, Rawalpindi, Beas, Madhopur, Multan; Abbottabad, Tall, Tonk; Poona, Bombay. *A. fuliginosus* from: Amritsar, Delhi, Rawalpindi, Kangra; Abbottabad; Agra; Mandla, Rewah, Balaghat, Hoshangabad, Hodel; Sibsagar, Jalpaiguri, Jeypore, Bombay; Tharrawaddy.

LISTON (Major W. G.) & AKULA (T. G.). **A *Stegomyia* Survey of the City and Island of Bombay.**—*Proc. Gen. Malaria Comm., Madras, 18th to 20th Nov.*, 1912, *Simla*, 1913, pp. 187-188.

Out of a total of 922 breeding places of Culicine larvae examined, 273 harboured larvae of *Stegomyia fasciata*, 249 of *Culex concolor*, 197 of *C. fatigans*, 104 of *Stegomyia sugens*, 56 of *Stegomyia scutellaris*, 29 of *Desvoidea obturbans*, 13 of *Taeniorhynchus obturbans*, and 1 of *Culex mimeticus*.

The first-named species showed special preference for certain kinds of breeding places, being found 106 times (or 39 per cent.) in wooden tubs containing water. Other selected breeding places were cisterns, 11 per cent.; iron vessels, tin pots, &c., 9 per cent.; wells, 8 per cent.; wooden barrels, 8 per cent.; cattle troughs, 4 per cent.; masonry, garden tanks, cess-pits, zinc baskets, 3 per cent. The water in almost every case was clean and free from putrifying material. Unlike *Stegomyia fasciata*, *S. scutellaris* was not found evenly distributed over Bombay Island, but was met with in the urban parts only, where the houses were surrounded by gardens and where shelter and shade were available. Like *S. fasciata* its favourite breeding places were wooden tubs and iron pots, such breeding places constituting about 48 per cent. of the whole. This mosquito exhibited rather a preference for iron vessels. It was rarely, though occasionally, found in pools and ditches filled with rain water. *Stegomyia sugens* was met with in different parts of the island, especially in the neighbourhood of the new docks. *Desvoidea obturbans* was generally found breeding in dirty water, coloured brown by organic matter in solution. The larvae were found in drains connected with stables, also in wooden tubs and hollows containing rain water, in iron girders and in disused machinery. The prevalence of of *Stegomyia fasciata* combined with the climate and trade relations of Bombay will favour the spread of yellow fever should the ports of the Far East become infected with the disease on the opening of the Panama Canal.

MHASKAR (Dr. K. S.). ***Stegomyia* in Karachi.**—*Proc. Gen. Malaria Comm., Madras, 18th to 20th Nov.*, 1912, *Simla*, 1913, pp. .

After a discussion on the physical aspects, climate, hydrography, rainfall, drainage and vegetation of Karachi, the breeding places of mosquitos in different parts of the town, in the civil lines, Kiamari and Manora, are dealt with. By far the commonest species is *Culex fatigans*, next in extent of distribution being *Stegomyia fasciata*, which is universally found in drinking water chatties, and never in foul and stinking cess-pits like *Culex*. The *Stegomyia* bite viciously during the day and are not scared by light. The brackish puddles in the marshes and mangrove-swamps showed species of *Taeniorhynchus* and *Anopheles*. *Anopheles rossi* was found in large numbers in the brackish wells at Manora and in salt-water tanks. *Culex concolor* was met with in a dozen places along with *C. fatigans*. *Cellia pulcherrima* was found only once. Besides the CULICIDAE, the sand-flies (*Phlebotomus*) were found everywhere and are a great pest at Manora.

HECKENROTH (Dr.). **Tournée médicale effectuée sur le Congo et L'Oubangui.** [Report of a Medical Tour on the Congo and Ubangi.]—*Ann. Hyg. Méd. Coloniales*, xvi, no. 1, March 1913, pp. 104-144, 4 maps.

The author says that sleeping sickness at first closely followed the great waterways of the Congo and Ubangi, afterwards establishing itself on its tributaries according to the commercial development of the country, especially on the M'Poko, Lobaye, Tomi and Kotto. He gives some details as to the present and past endemicity of sleeping sickness and cites cases in which a comparatively large population has been more than decimated. He lays great stress upon the danger of the transport of infection by natives leaving villages seriously attacked, and points out that the progress of Europeans along these rivers practically marks the progress of the disease. In certain posts and factories the proportion of cases was much higher than in the neighbouring villages, but in various other places where the disease was rife and epidemic the reverse was the case, and the author offers as an explanation the fact that the natives living with Europeans at these posts and factories were better clothed and better fed and that the clothing probably protected them to a large extent from insect attack. It was also remarked that Europeans are rarely attacked, even after a long stay in villages where the number of cases exceeds 25 per cent. and even 50 per cent. of the population.

Glossina palpalis was found along the whole course of the middle Congo and the Ubangi and two specimens of *G. fusca* were taken at Mpouïa. Along these two rivers the distribution of the tsetse does not coincide with that of the distribution of sleeping sickness. At Bonga, Lukolela, and Irebu flies were so numerous as to make canoeing on the river a torture, but it is precisely in this part that trypanosomiasis is actually the least frequent. At Mobaye and Kemo where 15, 20 and 30 per cent. of the population were sick, the occurrence of flies was almost exceptional on the French bank, at least at the time of year when the author reached the Ubangi, namely December and January; only six specimens were taken. The natives say that the fly is very abundant on the Belgian bank, which is low and wooded, and that there are plenty in the various islands in the Ubangi, and it is here that the specimens mentioned were captured. *G. palpalis* is stated to be very common in the Bangala country, not common in the Bondjo country and fairly common in the Mbaka country and in the region between Bangi and Fort-de-Possel, but scarce between this latter place and Mobaye.

Tables are given showing the relation of cases of sleeping sickness in the various divisions of the country and the author points out that there is no sort of parallelism between the distribution of the tsetse and the intensity of the disease. He is, therefore, led to suppose that possibly some other blood-sucking insect may be concerned and he gives the following as the result of his observations.

Culex and *Mansonioides* are very common from Bonga to Liranga, but become scarce at Impfondo; from Dungu to Betu only *Culex* was found, and these in quantity. From Betu to Bangi there were no mosquitos, though they reappeared at this latter place, but were much less numerous there than at Bakundu and Kemo or Fort-de-Possel (*Culex* and *Mansonioides*). There were a few mosquitos at Bessu and of the same species; at Kwango the number increased and *Anopheles* was taken for the first time. These three genera are not abundant between Kwango and Mobaye, but many *Anopheles* were found in the villages near the latter Station. The author noted that when *Anopheles* began to be taken cases of paludism also appeared, and of some hundreds of children examined nearly one-third had enlarged spleens and numerous haematozoa in their blood. *Stomoxys* is unknown to the natives and the author did not meet with one between Bonga and Betu. At Betu they are very scarce, but from that place to Bimbo they begin to be very abundant. From Bangi a good number of *Stomoxys* was found until Fort-de-Possel was passed, and there they were fairly numerous both on the river banks and in the villages. They are entirely absent at Kwango. Only a small number of TABANIDAE were seen in the districts of Bonga, Lukolela and Liranga; they are scarce above Bangi. Some *Haematopota* were taken at Bimba. SIMULIIDAE were abundant in the great epidemic centres of Bimbo, Yakoli, Bogassi and Mongumba. None were found at Ikumba, which is also a great sleeping sickness centre near those just mentioned. These insects only bite at nightfall, between 5 and 7 p.m., and in the early morning from sunrise to about 8 o'clock. Larvae of *Auchmeromyia luteola* are found in all the riverside villages.

The author says that the above facts are more or less contradictory and that the relationship between the distribution of biting flies and sleeping sickness in this area is somewhat difficult to understand. He considers that there is no longer any question that sleeping sickness can pass into and across districts in which there are no tsetses; whereas in those districts where *Glossina* is comparatively abundant, as at Bonga and Lukolela, it would appear that this fly plays a part in the distribution of the disease almost to the exclusion of all other biting insects which live rather in the villages than in the bush.

The extreme difficulty in carrying out bush-clearing on a large and really useful scale is insisted upon. The men of the villages in those areas where clearing is most urgent are constantly away from home as porters, etc., on the trade routes, and in many cases are themselves a source of danger to others.

NEUMANN (L. G.). **Un nouveau sous-genre et deux nouvelles espèces d'Ixodidés.** [A new sub-genus and two new species of ticks.] —*Bull. Soc. Zool. France, Paris*, xxxviii, no. 5, 1913, 27th June 1913, pp. 147-151.

The author proposed to erect the new sub-genus *Pterygodes*, for *Rhipicephalus fulvus*, sp. n., from Tunisia. From French Guiana he records *Amblyomma goeldii*, from a toad; *A. geayi*, from the three-toed sloth (*Bradypus tridactylus*); and *A. brimontii* sp. n., from *Testudo tabulata*.

SKINNER (Dr. H.). **How does the House-Fly pass the Winter?**—*Entom. News, Philadelphia*, xxiv, no. 7, July 1913, pp. 303-304.

The author has never been convinced that in the locality of Philadelphia the house-fly lives through the winter as an imago. His observations tend to show that the fly passes the winter in the pupal stage. Some house-flies caught on 13th March were all fresh specimens, even teneral in character, except in colour. The ptilinum was not completely retracted and it was evident that they had just emerged. The colours were bright and the wings were not frayed in any way, and there was no sign of dust or dirt on them. Both sexes were represented. The author's answer to his question is: House-flies pass the winter in the pupal stage and in no other way.

PORTCHINSKY (I. A.). **ОСЕННЯЯ ЖИГАЛКА; ЕЯ БІОЛОГІЯ ВЪ СВЯЗИ СЪ ДРУГИМИ МУХАМИ И БОРЬБА СЪ НЕЮ** [*Stomoxys calcitrans*; its biology in relation to that of other coprophagous flies].—ТРУДЫ БЮРО ПО ЭНТОМОЛОГІИ Ученаго Комитета Главнаго Управленія Землеустройства и Земледѣлія [Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture], viii, no. 8, 90 pp., 1 pl., 97 figs. St. Petersburg, 1910.

This memoir opens with a résumé of the more important literature dealing with *Stomoxys calcitrans* during the last 40 or 50 years. In Russia the existence of this fly appears to be closely connected with the horse; it occurs wherever there are horses and in quantities more or less proportionate to their numbers. During warm winters the flies have been seen even in December and January. They have been observed to feed on vegetable matter under natural conditions, and in captivity will feed on syrup or the liquid from decomposing vegetable matter or dung. The author points out that whereas *S. calcitrans* sucks the blood of horses, cattle and dogs, *Haematobia stimulans*, Mg., and *Lyperosia irritans*, L., feed only on the blood of horned cattle, on whose bodies they remain constantly, even while resting, showing, in his opinion, the beginnings of a well defined parasitism.

Distinctions are drawn between *Musca domestica* and *S. calcitrans* as regards structure, attitudes and habits. The maximum number of eggs found by the author in females of *Stomoxys* in South Russia was 116, whereas *M. domestica* lays 120 to 160 eggs which hatch in about half the time. Observations carried out during a whole summer confirmed Newstead's conclusion that *S. calcitrans* does not oviposit in horse or cattle dung in open fields and woods; and the same was found true of *M. domestica*. But in towns and around stables, etc., heaps of horse dung form the chief, if not the only, breeding places of *Stomoxys*, which however was never observed to breed in cattle dung in similar situations. Details are given of experiments which show the marked preference of the larvae for horse dung as compared with cattle dung or human excrement. But *S. calcitrans* is by no means purely a dung-feeder, and the author cites records of several other observers to the effect that it breeds in decaying vegetable matter, but does not mention having observed this in Russia. In South Russia the whole development from egg to imago occupied from 32 to 38 days; the egg stage lasting 24 hours, the larval stage 14 to 24 days, and the pupal stage 12 to 17 days. The larva and pupa are fully described, and the author expresses the opinion that the figures of the spiracles given by Howard and by Lahille are inaccurate. Among the enemies of *Stomoxys* Dr. Portchinsky mentions insects of the genera *Mellinus* and *Oxybelus*, as well as a Chalcid parasite.

The author then proceeds to discuss at length the habits of various other Diptera which breed in dung, and points out that their methods of reproduction form a regular series, first coming those species which lay numerous small eggs, then those which lay fewer large eggs, and finally every degree of larviparity. He suggests that this form of viviparity has been developed partly as a direct result of the keen competition for the food supply, and partly because the dung does not normally remain suitable as food for very long, owing to its rapid drying, especially in warmer climates. This, he thinks, explains why the egg-laying *S. calcitrans* and *M. domestica*, the larvae of which are unusually voracious, do not oviposit on dung in fields and woods, but have adapted themselves to the more favourable artificial conditions which are supplied for them by man himself, and which have the additional advantage of being free from many of the predaceous enemies, both dipterous and coleopterous, that abound under more natural conditions. He also advances the hypothesis that the tsetses (*Glossina*) originally bred in dung and have gradually developed the habit of depositing a full-grown larva owing to the difficulty of obtaining an adequate food supply.

Formerly the Russian peasants used fringed coverlets (some of which are described and figured) for protecting their horses from *Stomoxys*; but of recent years they have taken to smearing the animals with naphtha, or with fish liver oil, which is a very efficient preventive.

Among the remedial measures proposed by Dr. Portchinsky is the suggestion that horse dung, before being stacked in heaps for manuring purposes, should be spread in thin layers in the sun or wind, so as to dry it; this will free the dung from the larvae of *S. calcitrans* and *M. domestica.* Or again, the dung may be moistened with kerosene or naphtha waste, which will not destroy its fertilising qualities, but will only delay its decomposition. Stables should be sprayed with the same substances two or three times a week. Experiments are described showing that kerosene quickly kills the larvae of both these flies; chloride of lime is also very effective. The burning, or at least the thorough drying, of all waste products of agriculture, before stacking as manure, is also strongly recommended.

SERRES (J.). **Estridia de los ovinos** [*Oestrus ovis*].—*Gaceta Rural, Buenos Aires*, vi, April 1913, pp. 759-761.

This fly was first recognised in Argentina by R. Wernicke in 1888, and again by H. Rivas in 1889; since that time it has been constantly found and is now a well known pest. The life-history of the fly is described and the author says that the adults lodge in cracks and holes in the walls of sheepfolds, from which they emerge when the weather is hot and dry. The sheep endeavour to avoid them by flinging themselves on the ground and trying to bury their noses in the earth, or by gathering together in groups with their heads towards the centre. Sometimes it would appear that the sheep purposely raise clouds of dust by stamping on the earth to drive away the common enemy.

The symptoms and course of the disease are described in detail. Spontaneous cures occur occasionally, in consequence of the inflammation set up facilitating the expulsion of the larvae by violent sneezing.

The disease is exceedingly difficult of treatment; medication through the nasal fossae is useless and does not kill the larvae, but only worries them and causes them to change their position; further, their resistance to drugs, of any kind which it is possible to use, is very great. The author says that the only way of attacking them directly is to trepan the skull above the nasal fossae and remove the larvae, but this is impossible without the intervention of a skilled veterinary surgeon; and the best plan is to send infected animals to the slaughter house.

He considers that the fight against the adult fly is practically without result and is not worth attempting, but that something may be done by the patient destruction of all larvae which the sheep expel from their nostrils and also of all those found in the heads of slaughtered animals. The sheepfolds should be thoroughly lime-washed from time to time and all holes and cracks which might serve as lodgment for the flies should be carefully stopped up. Rivas has suggested painting the end of the nose of the sheep for two or three days with tar or with crude empyreumatic wood oil, which he says will prevent the attack of the fly.

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Splendore (A.). **Nuove osservazioni sul** *Toxoplasma cuniculi* [New observations on *Toxoplasma cuniculi*.]—*Atti R. Accad. dei Lincei, Rome,* xxii, no. 10, 18th May 1913, pp. 722-727.

In discussing the morphology and development of the *Toxoplasma* of the rabbit inoculated into pigeons, the author remarks that the sexual forms of this parasite must develop in some invertebrate host, the probability being that *Stomoxys* will be found to be the carrier.

Winslow (C. E. A.). **An Insect-borne Disease; Infantile Paralysis.**—*Amer. Museum Jl.*, xiii, no. 5, May 1913, pp. 229-235.

A popular résumé of investigations regarding the aetiology of poliomyelitis and the bionomics of *Stomoxys calcitrans.*

Portchinsky (I. A.). **ОБЫКНОВЕННАЯ ЗУБОНОЖКА; ЕЯ БІОЛОГІЯ И ИСТРЕБЛЕНІЕ ЛИЧИНКАМИ ЕЯ ЛИЧИНОКЪ КОМНАТНОЙ МУХИ** [*Hydrotaea dentipes*; its biology and the destruction by its larvae of the larvae of *Musca domestica*].—**ТРУДЫ БЮРО ПО ЭНТОМОЛОГІИ,** Ученаго Комитета Главнаго Управленія Землеустройства и Земледѣлія [Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture], ix, no. 5, 30 pp., 23 figs. St. Petersburg, 1913.

In this paper the author describes his studies of *H. dentipes* and its relation to other species of coprophagous flies, which are at the same time very fertile and practically omnivorous feeders. Such species, in the author's opinion, are driven by the competition between the numerous dung-feeding larvae in the open, to avoid these materials in depositing their eggs, and to seek the protection of man by using closed, protected spaces near his habitations. But even there the larvae of some of them (*S. calcitrans* and *Musca domestica*) are not quite safe, their existence being threatened by the rapacious larvae of *Hydrotaea dentipes*, which, like themselves, are very numerous and omnivorous and also cannot survive in the open. An accidental observation led the author to investigate more closely the relations between the larvae of these different flies; he noticed the rapid decrease of some larvae of *Musca domestica* in a glass in which he was breeding them, and having examined the dung, he found 3 larvae of *H. dentipes* which had evidently hatched from eggs left by accident in the glass in which he had previously kept some females of the latter fly. Further experiments invariably confirmed the total disappearance and destruction of the larvae of *M. domestica*, as well as of *S. calcitrans* by the rapacious larvae of *H. dentipes*. The author points out that both the females of *M. domestica* and *H. dentipes* oviposit freely in captivity and that he used for a bait in attracting the latter flies pieces of rotten meat in an open glass. As the larvae of *H. dentipes* breed also in rotten meat, the author experimented on their relations

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with *Lucilia caesar*, with similar results, all the larvae of the latter fly being very soon destroyed by those of the former. The larvae of *H. dentipes* become predaceous only upon reaching their third stage, and their method of destroying other larvae is described in detail, as well as an experiment which showed that the disappearance of the house-fly maggots was directly due to those of *Hydrotaea*.

The author further describes experiments on the relations between the larvae of *H. dentipes* and those of *Polyetes albolineata*, which are the most rapacious of all coprophagous larvae. Some of the latter having been placed on some horse-dung in which the larvae of *H. dentipes* had already destroyed a great many house-fly maggots, immediately attacked these victors and quickly killed and ate them. The resistance of the larvae of *H. dentipes* was usually fierce and persistent, but never successful.

Larvae of *H. dentipes* were never seen to attack each other, even when other food was scarce, while such cannibalism is often practised by the larvae of *Myospila meditabunda* and *Polyetes albolineata*.

The importance of *H. dentipes* as destroyers of the larvae of *M. domestica* and of *S. calcitrans* is very great; and they also present the following advantageous characteristics: they are very fertile, laying 170-200 eggs, maturing at about the same time; their larvae can travel very rapidly, and whether living in large companies, or singly (when grown up), never eat each other, even when hungry; the larvae are omnivorous feeders and will live on all materials serving as breeding places for the larvae of *M. domestica*; the flies do not trouble men and never visit human dwellings; and they can be readily reared in captivity.

Reference is made to a statement by Howard ("House Flies," Farmers' Bull. 459, Washington, 1911, p. 12) that in Washington, the heaps of horse-dung brought out daily from the stables of the Department of Agriculture, where 12 horses were kept, were swarming with the larvae of *M. domestica*, and the author suggests experimenting on these heaps with the larvae of *H. dentipes*. He describes his observations in a "fairly dirty" stable in the district of Tsarskoie Selo where he found no larvae of *M. domestica* or *S. calcitrans*, or only very few of the former, while the larvae of *H. dentipes* were always abundant. In his opinion, *H. dentipes* (in addition to other parasitic insects) is chiefly instrumental in preventing the multiplication of *M. domestica*, which otherwise, under the protection of man, would make human life intolerable.

The larvae of *H. dentipes* were seldom found in the open, nor in the large heaps of horse-dung in fields or woods, where they would have been destroyed by *Polyetes albolineata*; similarly they could not survive in human excrement in the open, as this is always inhabited by larvae of *Myospila meditabunda* and other flies. The eggs and larvae of this fly are safer in the dead bodies of animals in the open, as there they can feed on the larvae of *Lucilia caesar*. The flies of *H. dentipes* are found in woods, fields and gardens, not far from human habitations; their usual abode is the neighbourhood of stables. In size and form their eggs are very similar to those of *Musca domestica*, though a little shorter than the latter. The author points out that these flies, at least in his experience, never lay their eggs directly upon the material on which the larvae are to breed, but near it. In his opinion this cannot be regarded as accidental, but is done purposely, in order to prevent the tiny eggs from being damaged or destroyed by other flies or insects, if laid on the same material. Near St. Petersburg the eggs of *H. dentipes* hatch 36 hours after oviposition.

The larvae are described in all their stages. They are more or less long-lived, their development depending on the temperature, as well as on the quality and quantity of the food. In certain experiments the larvae lived long enough to allow of their devouring two and even three consecutive broods of larvae of *M. domestica*. When mature they pass into the earth, where they remain for some time before pupating; those which buried on 23rd July emerged only on the 11th August. In the latitude of the Government of St. Petersburg this fly can hardly produce more than two to three generations in a year. It is assumed by specialists that this fly is found everywhere in Europe.

The author further describes his observations on the insect fauna of the Southern part of the Government of Stavropol (North Caucasus), made from July to August, 1911. He visited there a number of newly founded farms which in his opinion, as regards their fly fauna, greatly resemble oceanic islands which are gradually inhabited by immigrant species, the farms being situated in a dry waterless steppe. There was a total absence of *Calliphora* and *Lucilia caesar*, the place of the latter being taken by *L. sericata*, which, however, contrary to experience in Holland and in England, is of no importance to sheep; likewise *Musca corvicina*, *Pyrellia cadaverina*, *Myospila meditabunda*, *Mydaea urbana*, *Polyetes albolineata*, and many other species of flies that are quite common on dung in other places, were not to be found. *Hydrotaea dentipes* was also absent, whilst *Musca ovipara* and *Plaxemyia* (*Musca*) *vitripennis* occurred seldom and then only singly. Besides the great heat, which makes the breeding of these flies almost impossible, owing to the dung drying too quickly, the fierce competition of numbers of dung-beetles would be against them.

The author found *Muscina stabulans* on these farms, but very seldom. Baits of rotten meat or of rotten melons attracted a remarkable collection of flies, the most numerous being *Sarcophaga latifrons* and some species of viviparous flies, such as *Sarcophaga melanura*, *S. cruenta*, *Wohlfahrtia magnifica* (which is very annoying and dangerous to sheep in these parts, some 25 per cent. and even more being yearly infested by its larvae), *W. balassogloi*, *Lucilia sericata*, *Phormia regina*, and two species of Tachinids—*Cnephalia bucephala* and *Tachina larvarum*. The author points out that of these vivaparous flies two species of *Sarcophaga* attack and parasitise a grasshopper, *Caloptenus italicus*, which in that year was widely distributed in this district; while *Wohlfahrtia balassogloi* in the larval stage is parasitic on the eggs of a large species of locust. The presence of the Tachinids was explained by the appearance in that year of great numbers of *Agrotis tritici*, the caterpillars of which they parasitise. *Musca domestica*, which seldom was attracted by the author's baits, appeared however in enormous quantities, all the outer parts of the house, the blinds and the linen covers of the doors from the outside, being covered by their excrement, while in the stables they caused a constant buzzing. *Stomoxys calcitrans* was also abundant usually settling on the outer walls of the stables. Notwithstanding all this, there were practically no flies in the rooms of the house, which the author attributes, not only to the general cleanliness, but also to a special precaution practised by the owner, who poured on the window-sills daily a solution of white arsenic and sugar in water; upon entering the rooms the flies, in this dry waterless country, immediately settled on the water and were poisoned. Sometimes the number of dead flies on the windows was so great that they were collected and used as food for the poultry, the latter never being injured by the poison. In the open country, away from the house, the numbers of *M. domestica*, in the total absence of their chief enemies, were very great.

Laws (H. E.). **The Tick-killing Properties of Sodium Arsenate.**—*Agric. Jl. Union of South Africa*, v, June 1913, pp. 915-921.

This is a continuation of a previous report [see this *Review*, Ser. B., p. 133] on the relative tick-killing properties of sodium arsenite and arsenate. The previous work indicated that arsenate was about half as active as arsenite, and this confirmed the opinion formed by Brunnich in Australia. He and other observers found that cattle dips, after standing for some time, deteriorated in strength and that this deterioration was due to the oxidation of the arsenite of soda to arsenate. Other observers have noticed that samples of dip which contained little or no arsenate on arrival at the laboratory contained nothing but arsenate when left standing for about a week. Williams, on examining the dip from a tank in regular use once a week, found that very little change took place in the dipping tank, but that if the dip was left standing in the laboratory, in a few months the whole was converted into arsenate. It would thus appear that to prevent the deterioration of the dip, cattle should be put through it at frequent intervals. Fischer has proved that the change is brought about by bacteria, and that these cannot operate unless the tank is allowed to stand undisturbed. The author discusses this question and says that it now appears that the formation of arsenate and the consequent reduction of the tick-killing effect of dips has been exaggerated, that arsenate of soda is in itself a valuable tick-destroying agent, and that there is very little difference between the activity of arsenate at 1 in 150 and arsenite at 1 in 300, but what difference there is is in favour of arsenite. Details are given of two series of experiments upon a number of cows lent for the purpose. The first series showed that arsenite 1 in 300, with and without emulsion, gave slightly better results than the arsenate 1 in 150 with emulsion, but they were not so good as those obtained with arsenate 1 in 100 with and without emulsion; thus it would appear that arsenate is slightly less than half as active as arsenite; further it was found that the comparative scalding effects of arsenite and arsenate are not proportionate to their tick-killing effects; the scalding effect of the arsenate being proportionately less. A second series of experiments to determine the scalding effect of sodium arsenate show that this poison when absorbed into the system in sufficient quantities will cause death, but spraying experiments (the method used by the author) are very unsatisfactory for detecting the scalding effect of a dip. In the author's opinion undue importance has been given to this question of deterioration of dips and the desire on the part of the farmers to have their dips tested at periodic intervals is a mistake and an unnecessary expense, except in those cases in which a dip tank has been left for some time without being used or when the tank has become flooded with rain-water.

Fuller (C.). **Fly Plagues. An Unusual Outbreak of** ***Stomoxys calcitrans*** **following Floods.**—*Agric. Jl. Union of South Africa*, v, June 1913, pp. 922-925.

On the 22nd April 1913 reports were received in Ginginhlovo, Zululand, enclosing specimens of *S. calcitrans* and stating that this fly was causing ulcerous sores in the skin of pigs, oxen and mules, disturbing the animals' rest and stopping their feeding. The reports added that the flies had only been in evidence since the floods. On the 2nd May a batch of *S. calcitrans* was received from Transkei, where they were reported to be attacking horses, mules, cattle and even sheep in places for a distance of roughly 30 miles inward from the coast; many cattle had been killed. In order to obtain relief the animals were reported to have stampeded into the sea and into rivers everywhere. The pest is said to have been intolerable in the areas mentioned for more than a month after the heavy rains experienced in March. Though the fly is common enough in South Africa, this is the first record of such an unusual outbreak; but similar cases have been observed and studied in the United States, where they were also accompanied by considerable loss of stock [see this *Review*, Ser. B. p. 96]. The author says that the farmer can do little to help his cattle except by giving them such direct protection as he can devise with the means at his disposal. Repellent smears and sprays have often been suggested, but experiment has shown that none of these give more than temporary relief, and some of those recommended have proved injurious to the animals. The best method of controlling *S. calcitrans* is by thoroughly scattering manure which contains straw and by avoiding the accumulation of decaying hay and other vegetable refuse. Working animals can also be protected by covers, and stall-fed stock by screening their stables. In connection with the unusual outbreaks of *Stomoxys calcitrans* experienced elsewhere, it has generally been found that epidemics of disease follow; thus, in red-water areas native and immune cattle are attacked by the disease, which is attributed to weakness and anaemia resulting from the attacks of the fly.

The fly is also accused of transmitting glanders and anthrax as a direct carrying agent.

The author has received from Transkei several specimens of *Simulium* obtained from sheep at Mevana, on the border between Libode and Port St. Johns. These flies were found fully gorged and attacking sheep in the neighbourhood of fly-blown sores. Horses which have died lately in that neighbourhood (probably from horse sickness) have been found to have their ears full of this fly and blood was oozing from the bites. A number of different species of *Simulium* exist throughout South Africa, but outbreaks must be regarded as rare, the flies being very local. One species is a great pest of poultry in certain districts round Capetown. The author says that the control of the insect in its earlier stages is quite impracticable and that stock can only be protected by burning smudges and by smears.

STRACHAN (Dr. H.). **West African Notes.**—*Jl. Tropical Med. & Hyg.*, xvi, no. 14, 15th July 1913, p. 214.

In some notes on the bites of the tsetse-fly (*Glossina palpalis*) the author mentions that there is grave danger of sleeping sickness extending southward along the river valleys of Southern Nigeria. It is noteworthy that the only cases which came to notice in the Western (Yoruba) Province of Southern Nigeria had been infected in other countries (such as Fernando Po, Congo, etc.), and that although *G. palpalis* abounds in the Western Province, and trypanosomiasis of horses and cattle is common, there appeared to be no instance of infection from the few immigrant cases of sleeping sickness which were detected by the Medical Department during the fourteen years that the author was there.

[The facts available do not appear to warrant the statement that there is 'grave danger' of the disease spreading in S. Nigeria. —ED.]

WARBURTON (C.). **On Four New Species and Two New Varieties of the Ixodid Genus** ***Haemaphysalis*****.**—*Parasitology*, vi, no. 2, July 1913, pp. 121-130, 8 figs.

The number of recognised good species of the genus *Haemaphysalis* now reaches 43, the majority being essentially Asiatic. One of the new species described in this paper (*H. aciculifer*), however, was taken from an antelope (*Cobus thomasi*) on the N.E. shore of Lake Edward, Uganda, in October 1911, by S. A. Neave. The other new species described are:—*H. aborensis*, taken on grass by S. W. Kemp (Abor Expedition) at Yambung, 1,100 ft. *H. howletti* was found by F. M. Howlett on a hill-pony at Rawalpindi. *H. kinneari* is described from a single female taken by N. B. Kinnear from a tiger at Kadra, Kanara, India, in November 1910. *H. cornigera* var. *anomala*, var. n., was taken from a wolf, 4 miles west of Koderma Station, Chota Nagpur, by Major O. A. Smith in August 1912. In its company were specimens of *H. bispinosa* var. *intermedia*, *H. leachi* and *Rhipicephalus haemaphysaloides*. *H. inermis* var.

aponommoides, var. n., is described from numerous females taken by Col. F. Raymond from a Himalayan zebu at Belgachia, Calcutta, in March 1912, in company with *Boophilus australis.*

NUTTALL (G. H. F.). **Notes on Ticks. iii. On Four New Species of** *Ixodes.—Parasitology*, vi, no. 2, July 1913, pp. 131-138, 4 figs.

The four new species of ticks described are:—*Ixodes kempi*, found on *Sciurus erythraeus intermedius*, at Kobo, 400 ft., India, by S. W. Kemp (Abor Expedition), 29th March 1912. *I. daveyi* is described from a single female found on a bird (*Gallirex johnstoni*) on Ruwenzori (6,000-8,000 ft.), Uganda, by S. A. Neave, in November 1911. *I. oldi* was found on a 'bush-cat' [a mongoose, *Herpestes paludosus*] at Komatendu, Sierra Leone, by J. J. Simpson, 13th August 1912. *I. ricinoides* was found on a swamp deer and on a musk deer at Wen-chwan-hsien, near Si-ho-hsien, China.

NUTTALL (G. H. F.). **Parthenogenesis in Ticks. (Preliminary Note.)**—*Parasitology*, vi, no. 2, July 1913, pp. 139-140.

The tick, *Amblyomma agamum*, was raised parthenogenetically through three complete generations upon cold-blooded animals, the natural hosts in Brazil, by Aragão (1912). As no males of this species have as yet been observed, it occurred to Prof. Nuttall to determine whether parthenogenesis occurs in ticks where males are found with females, and in making experiments with several species he obtained a positive result with *Rhipicephalus bursa*, which is common on sheep in parts of Southern Europe and Northern Africa. When males and females of this species are placed together upon sheep the gorged fertilised females abandon the host after 4-12 days and lay 5,000-7,000 eggs. When females alone were placed upon a sheep they remained upon it for 25-38 days and abandoned the host without having fully gorged themselves with blood. Some of them began to oviposit after a normal interval of time and many of the eggs shrivelled up. The number of eggs laid per female is smaller (about 2,000) than in females which have fed to repletion in the presence of males. A small proportion of the eggs gave rise to larvae. Other cases of parthenogenesis in Acari are discussed by Oudemans (Tijdschr. voor Entom. li, 1908, p. 71).

NUTTALL (G. H. F.). *Rhipicephalus appendiculatus*: **Variation in Size and Structure Due to Nutrition.**—*Parasitology*, vi, no. 2, July 1913, pp. 195-203, 4 figs.

The variability in size and structure of *Rhipicephalus* has been a cause of much confusion in classification, as noted by Warburton (Parasitology, v. no. 1, 1912). Experiments by the author show that there is a considerable individual variation in the size of adults of *R. appendiculatus* whose development has not been interfered with, while the structural variations in such forms are slight.

The great variation in size and structure observable in the genus is merely due to the imperfect nutrition of smaller individuals in their immature stages. It is only by determining the range of variability under experimental conditions that the limits of a species in this respect can be ascertained and the making of bad species prevented. Arranging the specimens in series from the largest to the smallest, all grades of modification in the various structures can be observed, a fact which agrees with what the author has found in this species of tick collected from different hosts under natural conditions.

Cunliffe (N.). **The Variability of *Rhipicephalus pulchellus* (Gerstäcker 1873), together with its Geographical Distribution.**—*Parasitology*, vi, no. 2, July 1913, pp. 204-216, 6 figs.

The variability of those structural characters which are usually employed (*e.g.* the scutum) in determining a species of the genus *Rhipicephalus* is discussed and illustrated by correlation and other diagrams in the case of the zebra tick (*R. pulchellus*). This tick is comparatively rare, since during a period of nine years only 44 consignments have been received by Prof. Nuttall. With three exceptions, it has been obtained only from British East Africa and Uganda, where it is widely spread; other localities being Zanzibar and British Somaliland. The following is an authentic list of its hosts:—Horse, ass, zebra, rhinoceros, wart-hog, wildebeeste, hartebeeste, waterbuck, lesser kudu, eland, fringe-eared oryx, impala, cattle, lion, striped hyena, domesticated and wild dogs.

Göldi (Prof. Dr. Emil A.). **Die sanitarisch-pathologische Bedeutung der Insekten und verwandten Gliedertiere, namentlich als Krankheits-Erreger und Krankheits-Überträger.** [The sanitary and pathological importance of insects and allied Arthropoda, especially as producers and carriers of disease.] 155 pp., 178 figs. R. Friedländer & Sohn, Berlin, 1913. Price 9*s*.

The author says in his preface that this book has arisen out of the needs of his university teaching, and the attempt to treat so large a subject in 155 pages, of which the equivalent of nearly 50 pages is occupied by illustrations, has resulted in the production of an excellent syllabus rather than a complete text-book. It is remarkable how much material has been dealt with in the limited space, and the author has in fact provided the outlines for a larger and more comprehensive work. Not only are the external characters of the principal disease-carrying insects and other arthropods fully shown in the illustrations, but special attention has been paid to the anatomy of mouth parts. Unfortunately the maps of the distribution of certain diseases throughout the world are much too small to be of practical value. The work is divided into three parts:—(I.) Puncturing, biting and stinging arthropods (28 pp.), in which the author groups those which by puncture or bite inject a poisonous secretion, such as scorpions, spiders, bees, the caterpillars of Lepidoptera possessed of stinging hairs, blister beetles and the like. (II.) Parasitic arthropods. Under this heading parasitic insects and Acari are dealt with, many of which are potential disease-carriers and some recognised as such. The author divides these into two classes, those which suck the blood of living animals only when opportunity occurs and those which invariably suck blood, but points out that this division is more or less arbitrary as the one class gradually merges into the other. In this section 50 pages are devoted to the various genera of biting Diptera; 30 pages to fleas, bugs, lice and ticks; and 10 pages to truly parasitic flies. (III.) Arthropods as disease-carriers. The third section is devoted to those diseases which are recognised as insect-borne, such as malarial and yellow fever, filariasis, and trypanosomiasis of man and animals, with an enumeration of the insects involved and some account of the organisms transmitted.

Dunbar-Brunton (Dr. J.). **Sleeping Sickness and Big Game.**—*Brit. Med. Journ.*, 19th July 1913, pp. 150-151.

The author gives the following observations on tsetse-flies made when he was employed in North East Rhodesia, close to the Western Congo border on the shores of Lake Mweru, which are fringed with bush infested by *Glossina palpalis.* The lake is full of fish and was formerly closely settled with villages. Out of 40,000 examinations made between August 1907 and August 1909 only 17 cases of sleeping sickness were found. The hills behind the lake were waterless and the game lived between these and the lake to which they came to drink. Herds of puku remained all day in the bush surrounded by flies. *G. morsitans* was not found except on the low part of the lake near the Kalungwisi River. This was so infested by *G. palpalis* as well, that the Government Station had to be removed because the flies came into the house from the river 100 yards below. There was a village of 2,000 inhabitants close by and although these people were bitten both by *G. morsitans* and *G. palpalis* no case of sleeping sickness occurred in it to the author's knowledge. At the upper end of the lake where the Luchina stream enters, *G. palpalis* is found, and a village 600 yards away has *G. morsitans.* Further back from the lake is a village called Lambine and close to it a stream in which sitatunga live and come out in the morning to feed almost in the village. The author says that he has never known a village so badly infested with *G. morsitans* as this. They attacked the natives and himself while conducting his examinations and refused to be driven away, and yet from this village he failed to obtain a single case of infection or any trace of enlarged glands.

If the sitatunga carry the trypanosome it is curious, he says, that there never was a case of sleeping sickness in this village. People were always coming and going from the infected villages on the lake and they had every chance of being bitten by *G. morsitans* when staying in this village. Though it was only in 1909 that public attention was called to the fact that sleeping sickness had been observed in the Luangwa Valley, previous to this (about 1906 or 1907) there had been some deaths following each other in rapid succession in the family of a cotton-grower on the banks of the river, who lost his mother, sister, brother and a friend within a very short time, though the author does not know the precise cause of death. The cotton-grower employed native labourers some of whom came from infected areas near Tanganyika. The author suggests that before the destruction of game in Nyasaland and North East Rhodesia, or indeed anywhere where sleeping sickness exists, is decided upon, a careful investigation should be made in other districts and the blood of all antelopes examined. It is possible that the bulk of them would be found to be free from either *T. gambiense* or *T. rhodesiense*.

HEISER (V. G.). **The Outbreak of Plague in Manila during 1912.**—*Philippine Jl. Science*, viii, B, no. 2, April 1913, p. 109-118, 1 map.

After an absence of six years in human beings, and five years among rats, plague was again found in the Philippine Islands on 19th June 1912. The outbreak in Manila and the sanitary measures employed are discussed. Among the factors concerned in the introduction of the disease, it is probable that infected rats were introduced in cargo which comes almost daily from plague-infected centres in Japan and China. The epidemic might also have been started by infected bed-bugs. In one case of human plague from Manila, bed-bugs were caught from the petate (straw mat) upon which the man died, and smears made from the intestinal contents showed plague-like bacilli; the pathological findings, however, were not confirmatory.

FOX (C.). **The Plague Outbreak in Iloilo.**—*Philippine Jl. Science*, viii, B, no. 2, April 1913, pp. 119-122, 1 map.

The outbreak of plague at Iloilo was a small circumscribed epidemic, occurring in the absence of demonstrable rat infection. The author is of opinion that it was an instance of bed-bug transmission, starting with a case of human plague, introduced into Iloilo from Manila, or possibly from a plague-infected foreign port; the reason for this conclusion being the absence of rat infection, the decidedly circumscribed foci, and the sudden cessation of the outbreak after the houses believed to be infected had been thoroughly treated to kill bed-bugs. It is to be regretted that an effort to secure bed-bugs was not made earlier in the campaign, so that inoculation experiments could have been carried on to prove or disprove the validity of the theory in this case. However, that bed-bugs may, and often do, carry plague infection has been proved beyond a doubt by various observers.

Laat (J. E. Van der). **Las garrapatas, grave plaga que debe desaparecer.** [Cattle Ticks, a serious pest which ought to disappear.]—*Boletin de Fomento, San José, Costa Rica,* iii, no. 4, 1913, pp. 259-263, 2 pls.

The author says that the practice of dipping cattle for ticks is now well established on a number of large estates in Costa Rica, and describes the method in use. The cattle are made to pass into a large concrete tank, down a gradual slope strongly fenced on both sides and with a similar exit at the other end, the bath being sufficiently deep to immerse the animals entirely. The liquid in the tank will last for a whole year and if the sides are properly constructed the waste is exceedingly small. The liquid can be maintained at the proper level by the addition of water, and by this arrangement as many as 400 or 500 animals can be passed through the tank in an hour. The average cost of construction of such a tank of moderate size would be $500, and the cost of dip sufficient for the passage of 10,000 animals is put at $100 to $125. In the opinion of some authorities the arsenical bath has proved of value against anthrax and blackleg. The author strongly urges the installation of cattle dips in all parts of the country, and says that the loss of cattle either directly or indirectly due to ticks is far more serious than is generally supposed.

Güell (A. R.). **El baño de immersión para el exterminio de la garrapata.** [The dipping bath for exterminating ticks.]—*Boletin de Fomento, San José, Costa Rica,* iii, no. 3, 1913, pp. 192-194, 1 fig.

In various districts of Costa Rica the cattle are suffering from a terrible plague of ticks and flies, as well as secondary evils, such as blackleg (pierna negra), &c. For fortnightly dipping is recommended a solution of 8 lb. of white arsenic, 24 lb. of sodium carbonate, 1 or 2 gals. of pine tar in 500 gals. of water; for a dip to be applied every three weeks: 10 lb. white arsenic, 25 lb. carbonate of soda, 1 or 2 gals. of pine tar in 500 gals. of water.

Coppens (—). **L'affection hypodermique du boeuf.** [Ox Warbles.] —*Annales de Médecine Vétérinaire, Ixelles-Bruxelles,* lxii, nos. 6 & 7, June & July 1913, pp. 309-328 & pp. 384-388.

This article is a summary of the whole subject and deals with the commercial loss caused, the bionomics of the warble fly, and the methods by which it may be destroyed. The author cites a statement by Godfrind, chemist to the War Ministry at Brussels, to the effect that the wearing property of warbled hides as leather is only 30 per cent. of that of sound hide. In Belgium it is estimated that out of 400,000 adult cattle slaughtered annually, nearly 50,000 are warbled. The results are given of an enquiry made in North Germany as to the percentage of warbled hides found amongst the stocks of leather merchants;

the range was from 75 per cent to 3·4 per cent. A similar enquiry in South Germany and Saxony showed a maximum of 9·9 per cent and a minimum of 1 per cent. and the total depreciation of value is estimated at £181,705. The following percentages of warbled hides are given for the various provinces: Rheinland 35, North Germany 22, Alsace 18, Oldenburg 15, Saxony 8, Baden 2, Bavaria 1, and Wurtemburg 1 per cent.

The author then goes on to discuss the loss caused by the fly interfering with the nutrition of cattle even some time before any warbles are developed, and also the considerable loss of milk so caused. M. Rasquin puts this at over 29 francs per head of milch cows per annum, which the author thinks is an understatement. The German Agricultural Journal puts the annual loss from this cause in millions of marks at:—Holland 7, England 120, Germany 90.

The author then describes *Hypoderma lineata*, *H. bovis*, *H. equi* and *H. diana* and discusses their bionomics, taking as his authority the report of the German Commission on the warble fly (H. Glaser, 'Ueber Dasselfliegen, Mitteilungen des Ausschusses zur Bekämpfung der Dasselfliege,' no. 2; Berlin, 1912), and the various views as to the manner in which the larva reaches the skin of the back are discussed at length. With reference to methods of combating the pest, it is stated that smearing with various tarry and oily lotions in common use is apparently of little avail; but in those districts in which cattle are put under shelter during the great heat of the day, that is to say from 10 a.m. until 5 p.m., the number of animals warbled is very limited, and possibly this may prove to be a useful preventive measure. The destruction of the larvae systematically carried out is probably the most practical method of combating the pest, and the following figures are given as the result of the application of this method at the Co-operative Dairy of Skjaerum-Molle, with a total head of cattle ranging from 3,800 to 4,000 in the period covered. In 1902, 2,082 milch cows and 1,721 young beasts were examined, at a cost of 403 francs and 96 days work, and 22,394 larvae were killed; in 1910, 2,219 milch cows and 1,338 young beasts were examined at a cost of 133 francs and only 3,875 larvae were killed. A further table shows that the native cattle in 1906 averaged 1·07 larvae per head, while purchased cattle averaged 17·4; and in 1910 the figure was 0·11 for the native cattle and 16·0 for cattle purchased outside, thus showing that the large amount of labour involved was caused by the imported cattle and that otherwise the owners would have been able practically to suppress the pest locally.

Bishopp (F. C.) & Wood (H. P.). **The Biology of some North American Ticks of the Genus** *Dermacentor*.—*Parasitology*, vi, no. 2, July 1913, pp. 153-187, 3 pl., 10 tables, 1 map.

In North America there are at least eight valid species of the genus *Dermacentor* and one variety. The species of the genus may be divided into two groups, based on their habit of moulting on or off the host. The former group comprises *D. nitens*, *nigrolineatus* and *albipictus*, the latter *D. hunteri*, *parumapertus*, *venustus*, *occidentalis* and *variabilis*. The present paper deals with the distribution, hosts, life-history and habits, and the economic importance of *D. albipictus*, *hunteri* and *nigrolineatus*.

D. hunteri, Bishopp, has been only found in Arizona, near Quartzsite and Supai (200 to 3,000 ft. alt.) on the mountain sheep (*Ovis canadensis gaillardi*), the parasites becoming engorged and dropping off the hosts during the fall and winter. None of the immature stages of the species have been taken in nature, but it is probable that they engorge on small wild mammals. In the laboratory the larvae, nymphs and adults were fed on guinea-pigs. The predominance of males, especially during the summer months, indicates that they remain on the mountain sheep for some time after the females drop off. This tick has not been collected on domestic animals, and the infested mountain sheep examined were apparently healthy and the one which bore the greatest number of ticks (ca. 35) was in fine condition.

In the United States, *D. albipictus*, Packard, has been found in Texas, New Mexico, Arizona, California, Idaho, Montana, Utah, Wyoming, Oregon and Washington. Little is known regarding the distribution of the species in Canada, although it undoubtedly occurs in the southern part of the Dominion. Dr. C. Gordon Hewitt states that this tick was taken at Huntingdon, B.C. from a horse which had been imported from Oregon; also in Quebec from elk (wapiti) brought from Wyoming. Since this species does not drop from the host to moult, the hosts from which adults have been taken must be considered as harbouring the immature stages as well. The host of the typical form is the moose, but the elk or wapiti is also commonly attacked, and the tick has also been found on the beaver. The horse is preferred as a host among domestic animals, but the ox is frequently infested. A single female of *D. albipictus* was collected from a mule deer (*Odocoileus hemionus*) killed near Darby, Montana. Many adults and some nymphs were also found on mountain goat in the same locality. The tick has been reared experimentally from larva to adult on the guinea-pig and tame rabbit, as well as on the ox and horse. On a number of occasions larvae of this species were placed on sheep and goats, but a few that were attached died two days later, and hundreds died in the greasy wool without being able to reach the skin. In the warmer portion of the country (*e.g.*, Texas) where this tick occurs the larvae may hatch during the summer but remain inactive until cool weather. In the colder parts of its range (*e.g.*, Montana) the hatching does not take place until late summer or fall. In either case the larvae attach themselves to hosts when favourable weather prevails during autumn, winter and spring.

Until very recently *D. albipictus* has been considered of little or no economic importance. But the authors' investigations show that it is an important pest of horses, and, in a lesser degree, of cattle. In California, Oregon and Montana horses and colts become very weak, and the latter not infrequently succumb if the ticks are not promptly killed. During the spring, in territory infested by the Rocky Mountain spotted fever tick

(*D. venustus*), the combined attack of these two species, together with a shortage of feed, often causes the death of numbers of horses. In Oregon, H. H. Hach observed a great difference in the susceptibility to attack of different horses even when kept under identical conditions. Such a tendency to immunity was also shown by cattle. This resistance appears to be due largely to an unusually strong tendency to form scabs at the point of attack, thus healing the wound and throwing off the tick with the scab. It was observed that in cattle the ticks became attached in numbers on the neck and along the back, particularly above the shoulders and near the base of the tail.

The third species of *Dermacentor* described in the present paper is *D. nigrolineatus*, Packard, regarding the distribution of which comparatively little is known. It has been recorded from the Adirondacks, the Catskill Mountains, Wisconsin, Tennessee and Texas. Most of the specimens have been collected from deer (*Odocoileus virginianus texanus*), and Stiles records females and nymphs from horses. The authors collected all stages on cattle in Tennessee and have reared species experimentally on that host. The ticks would not feed on the guinea-pig, but attached themselves to tame rabbits, though none of them became engorged, probably owing to being scratched off. Like its nearest relative, *D. albipictus*, this species usually feeds during the autumn, winter and spring, and passes through both moults on the host.

D. nigrolineatus appears to be of little general economic importance, although locally it sometimes infests cattle sufficiently to reduce greatly their vitality and flesh. The only locality in which the authors know of its occurrence as a pest is in Fentress Co., Tennessee. The backs and hind-quarters of the animals are usually the most heavily infested.

MacGilchrist (Major A. C.). *Stegomyia* **Survey, Port of Calcutta.**—*Proc. 3rd Meeting Gen. Malaria Comm., Madras*, 18th to 20th Nov. 1912, pp. 193-196. Simla, 1913.

Two species of *Stegomyia, fasciata* and *scutellaris*, occur in the Port of Calcutta, and are known to bite in the daytime. The former species is a city mosquito and has not been found in any of the villages on the banks of the Hooghly below Garden Reach. *S. scutellaris* is often found breeding some 100 yards away from inhabited houses and is exceedingly common throughout the port. The only other mosquitos that bite in the day belong to the genus *Desvoidya*, the commonest being *D. obturbans* which breeds in foul stagnant water. *Leucomyia gelida* was very common in Calcutta and neighbourhood during August and September. Two species of *Toxorhynchites* were found extensively. A *Toxorhynchites* larva can easily devour half a dozen good-sized larvae of another genus in about half an hour. It was observed that individuals of *S. fasciata* not infrequently copulated with individuals of *S. scutellaris*; but this crossing seems to be unproductive. The breeding places attractive to these species and measures for their destruction are discussed.

Horne (Capt. J. H.). **Notes on Distribution and Habits of *Stegomyia* Mosquitos in Madras.**—*Proc. 3rd Meeting Gen. Malaria Comm., Madras*, 18th to 20th Nov. 1912, pp. 197-199. Simla, 1913.

A preliminary survey of the mosquitos in the town of Madras showed that *Stegomia fasciata* is more widespread than *S. scutellaris,* the former species being essentially a house mosquito, whereas the latter is common where there are trees, and is apparently an outdoor mosquito. Occasionally the author has been bitten by *S. fasciata* between 7 and 10 p.m. *Stegomyia sugens, Desvoidya* sp. and probably a *Reedomyia* were also found. The breeding places are enumerated and their elimination recommended.

O'Gorman Lalor (Major N. P.). **A Brief Report of the *Stegomyia* Survey in the Principal Ports of Burma.**—*Proc. 3rd Meeting Gen. Malaria Comm., Madras,* 18th to 20th Nov. 1912, pp. 201-203. Simla, 1913.

Stegomyia fasciata, S. scutellaris and *Devoidya obturbans* have been found to breed in Rangoon. The breeding places are enumerated and an account of laboratory experiments given which were conducted with a view to the discovery of a cheap and effective larvicide. The following alone were found to satisfy the required condition: Cyllin, 1 in 1,250; and coal tar and turpentine in equal parts, emulsified with ·075 grms. of Hudson's extract of soap to each cc., 1 in 2,500.

O'Farrell (Capt. W. R.). **Preliminary Note on a New Flagellate, *Crithidia hyalommae*, sp. nov., found in the Tick *Hyalomma aegyptium* (Linnaeus 1758).**—*Jl. Trop. Med. & Hyg.*, xvi, no. 16, 15th Aug. 1913, pp. 245-246, 8 figs.

A description of a new protozoal parasite found in the common cattle tick of the Anglo-Egyptian Sudan, *Hyalomma aegyptium.*

Townsend (C. H. T.). **A *Phlebotomus* the practically certain Carrier of Verruga.**—*Science,* xxxviii, 8th Aug. 1913, pp. 194-195.

The author has been conducting experiments on laboratory animals with blood-sucking arthropods at Chosica, Peru, with a view to solving the verruga problem. At first he inclined to the view that the disease is transmitted by Acari, but as no Argasid ticks commonly occur on mammals in the verruga zones, and the presence of Ixodid ticks will not explain the night infection, such transmission now seems improbable. The experiments upon animals with the blood-sucking gamasid mites of the vizcacha have led to no results. Culicids, *Simulium,* Tabanids, *Stomoxys,* fleas, lice and bugs are all precluded either by their extended occurrence, by their dependence on man, or by their day-biting proclivities. The author's attention having been drawn to Marett's investigations on *Phlebotomus*, the habits of the early stages and of the flies fit so well into the conditions obtaining in the verruga zones that, in spite of the fact that there has hitherto been no record of the occurrence of *Phlebotomus* in Peru, or anywhere in the Pacific coast region, the conclusion was irresistible that a *Phlebotomus* must be the carrier of verruga. Night collecting at Chosica just below the limits of the verruga zone never disclosed any *Phlebotomus*. However, passing the night of 25th June 1913, at San Bartolomé in the verruga zone of the Rimac valley, the author was able to find several specimens of *Phlebotomus*, besides *Ceratopogon* and other Chironomids. The natives call all the nocturnal gnats "titira," but the more intelligent distinguish the true titira as the *Phlebotomus*, stating that it has white wings. The fact that *Phlebotomus* avoid wind, sun and full daylight coincides with the localisation of verruga in deep and hot cañons where there is much vegetation and little ventilation. The flies suck the blood of almost any warm-blooded animal, and even that of lizards. Thus they are quite independent of man, and this accords with the verruga reservoir being located in the native fauna. The author is confident that the transmission experiments on laboratory animals will demonstrate the agency of *Phlebotomus* in the transmission of the disease.

DYAR (H. G.) & KNAB (F.). **Three New Neotropical Mosquitos.**—*Insecutor Inscitiae Menstruus, Washington*, i, June 1913, pp. 76-78.

Descriptions of *Sabethes chroiopus*, sp. n., from Potaro Highlands, British Guiana; *Aedes ioliota* sp. n., from Trinidad, where the larvae were found in water in a hollow tree; *Uranotaenia hystera*, sp. n., from Manoa, Orinoco River, Venezuela.

JOHNSTON (T. H.) & HARRISON (L.). **A Census of Australian Mallophaga.**—*Proc. Roy. Soc. Queensland*, xxiv, 1913, pp. 1-15.

A list of Australian Mallophaga and their avian and marsupial hosts.

JOHNSTON (T. H.) & HARRISON (L.). **A List of Mallophaga found on Introduced and Domesticated Animals in Australia.**—*Proc. Roy. Soc. Queensland*, xxiv, 1913, pp. 17-22.

The hosts of Mallophaga recorded in this paper are:—The common fowl, turkey, guinea-fowl, pheasant, silver pheasant, peacock, Indian dove, goose, duck, muscovy duck, swan, starling, skylark, ostrich, ass, horse, ox, sheep, goat, cat and guinea-pig.

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JOHNSTON (T. H.). **Notes on some Entozoa.**—*Proc. Roy. Soc. Queensland*, xxiv, 1913, pp. 63-91, 5 pls.

The larval stage of the parasite, *Habronema muscae* has been met with in *Stomoxys calcitrans* and *Musca domestica* in Sydney, and in the latter species in Brisbane. The larval form does not seem to have been previously recorded from Australia. Ransom has recently shown that *H. muscae* infests the stomach of the horse. A larval worm resembling the above species occurs in the head region of the common 'cattle fly' (*Musca vetustissima*) frequenting especially the eyes of cattle in Queensland.

As a result of examining a large series of rat fleas, small coiled nematode larvae (*Agamonema* sp.) were detected in a goodly number of *Xenopsylla cheopis* and, once, of *Ceratophyllus fasciatus*, all the parasitised fleas coming from Sydney and district. So far as the author is aware the presence of larval nematodes in fleas has not been previously recorded. From one to six of them have been found in the body cavity of a single *X. cheopis*. Usually the parasite was closely and spirally coiled, and sometimes enclosed by a relatively thick cyst. The whole larva resembles *Habronema muscae*, and the author therefore considers it to be a young form of a *Spiroptera* (sensu lato). As the species of *Spiroptera* which infests rats and mice in Australia is *S. obtusa*, it is quite likely that the larvae under review belong to this species.

The cysticercoid stages of *Hymenolepis diminuta* and *H. murina* were found in *X. cheopis* and *C. fasciatus*, as many as nine cysticercoids of *H. murina* being detected in a rat flea of the latter species on one occasion, but usually only one larva is present. On another occasion three cysticercoids of the same species were found in an *X. cheopis* from *Mus decumanus*.

JOHNSTON (T. H.) & HARRISON (L.). **A Note on Australian Pediculids.**—*Proc. Roy. Soc. Queensland*, xxiv, 1913, pp. 105-109.

The following is a list of Pediculids known to occur in Australia :—

MAN : *Pediculus capitis, P. humanus* (*vestimenti*), *Phthirius pubis*.

MACAQUE MONKEY : *Pedicinus eurygaster* (Sydney and Melbourne Zoological Gardens).

DOG : *Linognathus piliferus* (N.S.W., Victoria, Queensland).

PIG : *Haematopinus suis* (Tasmania, Victoria, N.S.W., Queensland, W. Australia).

CATTLE : *Linognathus vituli, Haematopinus eurysternus* (N.S.W., Victoria, Queensland, Tasmania).

DROMEDARY : *Haematopinus tuberculatus* (N.W. Australia).

HORSE : *Haematopinus asini* (N.S.W.).

SHEEP : *Linognathus ovillus* (N.S.W., S. Australia, N.Z.).

RABBIT : *Haemodipsus ventricosus* (N.S.W.).

RATS (*Mus decumanus* and *M. rattus*) : *Polyplax spinulosus* (Sydney, Melbourne, Brisbane) ; *P. bidentatus* (Lake Torrens).

WATER RAT (*Hydromys chrysogaster*) : *Polyplax bidentatus* (S. Australia, Sydney).

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Macfie (J. W. Scott). **On the Morphology of the Trypanosome (*T. nigeriense*, sp. n.) from a case of Sleeping Sickness from Eket, Southern Nigeria.**—*Ann. Trop. Med. & Parasit.*, vii, 3 A, 11th Aug. 1913, pp. 339-356.

Early in 1912 attention was drawn to the presence of a disease resembling sleeping sickness in the Eket district of Southern Nigeria. The parasite, of which a preliminary account is given, differs in several respects from a typical strain of *T. gambiense* and the author proposes for it the name *T. nigeriense.* The Eket district is densely populated and the country is an undulating plateau covered with dense bush, and intersected by numerous waterways; it includes much swampy land. The dirty towns obtain their water supply at two or three spots which are closely surrounded by bush and trees, and approached along a narrow shaded path. The children and young adults are the water-carriers, and Dr. Foran considers that this accounts for the majority of the cases of sleeping sickness occurring in young people. Dr. J. J. Simpson records *Glossina palpalis* and *G. caliginea* from Eket, but according to Dr. Foran *G. tachinoides* is also a common species, at any rate, during the months of September and October. If this is true, it is a remarkable fact, as *G. tachinoides* does not occur so near the coast elsewhere in Southern Nigeria. It is generally found inland, beyond the forest zone. It has been observed that the tsetse-flies appear to follow pigs about more than any other animal, and it is generally easier to catch the flies where these animals are than at the water. Sleeping sickness has apparently existed beyond the memory of the oldest inhabitants of the district. They state, however, that it has become more common lately, and this they attribute to the fact that the present generation ignores old native laws that forbade an infected person to associate with his fellows.

Balfour (Dr. A.). **A Year's Anti-Malarial Work at Khartoum.**—*Jl. Trop Med. & Hyg.*, xvi, no. 15, 1st Aug. 1913, pp. 225-232, 4 tables, 1 map, 5 figs.

This paper is an account of the anti-malarial work at Khartoum for the year 1912, considering it mainly, but by no means wholly, from the epidemiological point of view. The climatic conditions favoured a prevalence of malaria and the town is suffering from the lack of attention paid to the irrigated areas along the Nile to the north, and far outside the municipal boundaries, these areas constituting a serious nuisance as nurseries for Anophelines. Three genera of mosquitos are commonly found in Khartoum, i.e., *Culex*, *Stegomyia* and *Pyretophorus*. The latter is represented by a single species, *P. costalis*, which the author, judging from his experience of the Northern Sudan, considers to be one of the worst of malaria-carrying mosquitos.

The incidence of malaria and mosquitos is demonstrated by statistical tables and reference to a special map (1,000 yds. to 1·8 inches) of Khartoum. Steamers and boats were again operative throughout the year as introducers of mosquitos, both in the larval and adult stages. But once the quarantine station with its zeers and trap pits became established, a marked improvement resulted, as had been foretold. The site of the station a little to the east of Mogren village is very suitable, as the reclaimed land to the south is still destitute of human habitations, and mosquitos driven ashore either hang about and lay eggs in the zeers and pits, are destroyed at the station, or are carried by the north wind to Tuti Island where they can do little damage and their broods are found and killed.

Last summer, trains were for the first time found to be operative on a considerable scale as mosquito carriers. Trains from the north pass close to Anopheline-ridden farms, while those from the south pass along the Tayiba cultivation near Wad Medani, which for a time also harboured Anophelines. Mosquitos of the subfamily MEGARHININAE occurred round the central station. They have not hitherto been discovered in the Sudan and must have been introduced by the railway. It will probably be necessary to establish a quarantine trapping station here also, at least during rainy seasons.

The connection between meteorological conditions and the incidence of malaria are discussed. Of the 87 cases of locally acquired primary malaria notified during the year the great majority followed the rainfall of August. The author lays stress on the danger of irrigated areas generally, and on the part they play as 'attraction centres.' When the Gezira to the south of Khartoum is irrigated on a large scale, the Sudan Government will be face to face with a very serious problem. But with due care and stringent enforcement of existing regulations any danger should be comparatively easily averted.

As regards larvicides, petroleum has its limitations, for in pools exposed to a high wind it gets blown aside, leaving an untreated water surface on which mosquitos readily lay their eggs. Hence the workers at the Wellcome Tropical Research Laboratories have come to rely more or less on such preparations as sanitas-okol. Mr. H. H. King, the entomologist, found that izo-izal kills or renders moribund all larvae of *Pyretophorus costalis* in half an hour when in a strength of 1:30,000. A preparation of 1:40,000 is effective in one and a half hours. Pupae require a stronger emulsion. Owing to its higher price it does not seem to possess any advantage over sanitas-okol, which is a very satisfactory larvicide. Creosote has also been tried, but does not seem to have any special virtue to commend it, though perhaps a more extensive trial is required. For dealing with adult mosquitos in the cabins and holds of steamers the method of cresyl fumigation, described by Bouet and Roubaud, is being employed, and in addition the special spray together with the 'Mücken' fluid recommended by Giemsa. This consists of a special tincture of pyrethrum, soft soap and glycerine, the fluid being diluted for use with twenty times its amount of water.

The mosquito trap used in houses is on the lines of those advocated for sandflies, and consists of a wooden box lined with a dark material or painted black inside. There is a hinged door closing it below, and in this trap door there is a hole which can be closed by a metal slide and through which fumigation can be conducted. An inspection door guarded by mosquito netting completes the simple apparatus, which has already proved useful.

"The lesson which has been learned in Khartoum is that in this anti-malarial warfare the motto must be defiance, not defence."

TEICHMANN (E.). **Die tierischen Trypanosomen-Krankheiten Deutsch-Ostafrikas.** [Animal trypanosomiases in German East Africa.] — *Entom. Zeits., Frankfurt a. M.*, xxvii, no. 20, 16th Aug. 1913, pp. 109-110; no. 21, 23rd Aug. 1913, pp. 118-119.

A popular account of animal trypanosomiasis in the German Protectorate. The author declares that the destruction of big game is not advisable, as the latter are a valuable financial asset. He further pleads for research on tropical diseases regardless of immediate practical results.

NEWSTEAD (R.). **A new Tsetse-fly from the Congo Free State; and the Occurrence of *Glossina austeni* in German East Africa.**— *Ann. Trop. Med. Parasit.*, Series T.M., vii, no. 2, 10th June 1913, pp. 331-334, 2 figs.

The author describes a new species of tsetse, collected in the Congo Free State, under the name of *Glossina severini*, sp. n. He also states that he has received from Dr. Morstatt of Amani, German East Africa, two male and ten female specimens of *G. austeni*, Newstead. They were taken at Nyussi in the Tanga district in January and February 1913. This is the first recorded instance of the occurrence of the species in German East Africa, though the author remarks that there is nothing surprising in its being found there, as it has recently been recorded from Portuguese East Africa.

KINGHORN (A.), YORKE (W.) & LLOYD (L.). **Final Report of the Luangwa Sleeping Sickness Commission of the British South Africa Company 1911-1912.** — *Ann. Trop. Med. Parasit.*, Series T.M., vii, no. 2, 10th June 1913, pp. 183-302, 11 pls.

Section I. (by Kinghorn and Yorke) deals with *Trypanosoma rhodesiense.* When first described it was only known to exist in the Luangwa Valley, but it has become apparent that the disease is much more widely disseminated. It has been found in the districts south of Fort Jameson and to the west of Serenje. The parasite has been found in wild game near Ngoa and in a native dog in a village on the Nyasaland boundary, and in North Western Rhodesia it exists in at least one locality between Broken Hill and the Anglo-Belgian boundary. A case of sleeping sickness has recently been diagnosed in Southern Rhodesia, but the authors say they are not in a position to state the identity of the organism.

The authors summarise their results as follows:—

1. The human trypanosome (*T. rhodesiense*) is distributed widely throughout South Central Africa.

2. There is no essential difference between the clinical manifestations of the disease in man caused by *T. rhodesiense* and that due to *T. gambiense*, except possibly the greater virulence of the former.

3. *T. rhodesiense* is transmitted in Rhodesia by *Glossina morsitans*.

4. Approximately 3·5 per cent. of the flies may become permanently infected and capable of transmitting the virus.

5. The period which elapses between the infecting feed of the flies and the date on which they become infective varies from eleven to twenty-five days in the Luangwa Valley.

6. Attempts carried out at laboratory temperature on the Congo-Zambesi plateau during the cold season to transmit the human trypanosome by means of *G. morsitans* were invariably unsuccessful in spite of the fact that 680 flies were used in these experiments.

7. The developmental cycle of *T. rhodesiense* in *G. morsitans* is to a marked degree influenced by the temperature to which the flies are subjected. High temperatures (75-85° F.) favour the development of the parasite, whilst low temperatures (60°-70° F.) are unfavourable.

8. The first portion of the developmental cycle can proceed at the lower temperatures, but for its completion the higher temperatures are essential.

9. The parasites may persist in the fly at an incomplete stage of their development for at least sixty days under unfavourable climatic conditions.

10. These observations afford an adequate explanation of the extremely long latent periods of trypanosomes in *Glossina* which have occasionally been observed by various workers.

11. The relative humidity of the atmosphere has apparently no influence on the development of the trypanosome in *G. morsitans*.

12. Mechanical transmission does not occur if a period of twenty-four hours has elapsed since the infecting meal.

13. *G. morsitans*, in nature, has been found to transmit the human trypanosome.

14. The chief reservoir of the human trypanosome is the antelope.

15. The results of examination for the human trypanosome of the blood of a large number of monkeys, wild rats and mice were invariably negative.

In Section II. the same authors discuss the trypanosomes of game and domestic stock and say that in the Luangwa Valley a great variety of game is found, but domestic stock is very scarce and in some districts non-existent. A few goats are occasionally found and there is some evidence to show that these animals under natural conditions are not so insusceptible to trypanosomiasis as is locally supposed.

The natives recognise the impossibility of keeping dogs in fly-infested areas. At Ngoa, on the Congo-Zambesi watershed, game is abundant at certain seasons of the year, and goats and dogs are kept in many of the villages. Tsetse-flies are common near some of these, and domestic stock, such as there is, appears to thrive. Trypanosomes were occasionally found in goats. Tables are given showing the occurrence of trypanosomes in various kinds of game. The percentage of big game infected with trypanosomes in the Luangwa Valley is estimated at 50 and at Ngoa at 35. Six species of these parasites were isolated from game at Nawalia.

In Section III. the authors discuss trypanosomes found in wild *G. morsitans*. The flies were brought to the laboratory and fed on clean monkeys which were the only animals available for the purpose. Out of 3,202 flies used, at least 19 were capable of infesting monkeys at Nawalia and at Ngoa 5,250 flies gave the following results:—1:312 were found to be infected with *T. ignotum*, 1:1312 with *T. rhodesiense* and 1:5250 with *T. pecorum*.

In Section IV. trypanosomes are described and figured and in Section V., in conjunction with L. Lloyd, the authors discuss the development of *T. rhodesiense* in *G. morsitans*, summarising their results as follows:—

1. The salivary glands of all *G. morsitans* capable of transmitting *T. rhodesiense* are infected, and conversely, without invasion of the salivary glands there is no infectivity of the fly.
2. Invasion of the salivary glands is secondary to that of the intestine.
3. The first portion of the developmental cycle of the trypanosome takes place in the gut. In order for its completion and for invasion of the salivary glands to occur, a relatively high mean temperature (75°-85° F.) is necessary.
4. Invasion of the salivary glands was only found in flies infected with the human trypanosome, *T. rhodesiense*.
5. The predominant type of the trypanosome in the intestine of infected *G. morsitans*—a large broad form—is quite different from that which predominates in the salivary glands, where the parasite resembles somewhat the short form seen in the blood of the vertebrate host.
6. Both the intestinal forms and also those from the salivary glands of infective *G. morsitans* are virulent when inoculated into healthy animals.

In Section VI. the entomologist, Mr. L. Lloyd, describes the method of handling *G. morsitans* in the laboratory and says that the flies were fed on native fowls at Nawalia and afterwards for a short time on goats; at Ngoa they were fed first on fowls and then entirely on goats which died quickly under the repeated feedings, doubtless owing to the trypanosomes with which the flies were naturally infected. He then goes on to describe some breeding places of *G. morsitans* near Ngoa, with plates, showing that the pupae were found in association with trees of eight different species and in holes in the earth. All these trees were either abnormal or injured. No pupae were found at the bases of normal trees or bushes and they were generally, though not always, hidden under a slight covering of earth or dead leaves.

Of the fifty-four living pupae found forty-nine were so placed that they would be daily warmed by the sun. They were collected in the coldest part of the year, and at a time when flies were emerging from pupae in the laboratory after a period of from 75 to 85 days. This protracted period would be much reduced in pupae which were exposed to the warming influence of the sun.

From observations made, an increase of 1° in the mean temperature causes a reduction in the pupation period of from three to five days.

The following list of bloodsucking insects and ticks collected in the Luangwa Valley from August 1911 to March 1912, and at Ngoa from March to May 1912, is given, with notes as to localities, numbers, etc.

Ornithodorus moubata, the Nkufu Tick, was taken in three villages in the neighbourhood of Chinunda. In two cases it occurred in single huts in very large numbers but was said not to have been seen in any others. In the third village it was found in two huts, in one of which it was numerous while in the other a deserted hut, a single specimen was taken. The author says that the absence of this pest from the Nawalia district is peculiar, as it must be constantly introduced from the higher ground where it is common. The natives attribute the absence to the heat, but a number of ticks brought to Nawalia from the above-mentioned villages lived and bred in the laboratory throughout the hot weather.

Only one species of *Chrysops* (*C. fuscipennis*, Ric.) and only one specimen was taken at Nawalia. The following species of *Tabanus* were collected:—*T. africanus*, Gray, *T. biguttatus*, Wied., *T. par*, Walk., *T. liventipes*, Surc., *T. nigrostriatus*, Ric., *T. taeniola*, P. de B., and var. *variatus*, Wlk., *T. fraternus*, Macq., *T. fuscipes*, Ric., *T. albipalpus*, Wlk., *T. pullulus*, Aust., *T. claritibialis*, Ric., *T. atrimanus*, Lw., *T. copemani*, Aust., *T. diversus*, Ric., *T. maculatissinus*, Macq., and five other species, one believed to be as yet undescribed and the remainder not yet identified.

Haematopota are said not to be nearly so common as *Tabanus*, either as regards species or individuals. They were most numerous in January and February, but very scarce after the latter month. The following species have been identified:—*H. mactans*, Aust., *H. insidiatrix*, Aust., and an undescribed species previously collected in Northern Rhodesia.

Glossina morsitans, the only species of this genus met with, is generally distributed over the area investigated by the Commission. *Auchmeromyia luteola* is common both in the Luangwa Valley and on the plateau. The adult insect is to be found throughout the year. The larvae of *Cordylobia anthropophaga*, Grünb., were several times seen in the legs of wild rats. A few specimens of *Stomoxys nigra*, Macq., were found at Nawalia in January resting on grass near a swampy stream. *S. calcitrans* was very numerous at Mpika in March about the cattle kraals, but in May only one or two could be found. *Hippobosca hirsuta*, Aust., was taken repeatedly on waterbuck and on puku. Two other species, one wingless, were also collected at Nawalia and have still to be identified.

In appendix " A," A. F. Wallace and L. Lloyd describe experiments on the possible transmission of trypanosomes by *Tabanus*. Although 128 flies were used, the results were negative.

In appendix " B," A. F. Wallace describes an attempt to transmit *T. rhodesiense* by means of *Ornithodorus moubata;* 125 ticks were used and 5 sets of experiments made. The results were negative.

Roubaud (E.). **Recherches sur les Auchmeromyies, Calliphorines à larves suceuses de sang de l'Afrique tropicale.** [Researches on *Auchmeromyia*, Calliphorine flies with blood-sucking larvae from tropical Africa.]—*Bull. Scient. de la France et de la Belgique, Paris,* xlvii, fasc. 2, 24th June 1913, pp. 105-202, 2 pls., 32 figs.

This paper contains a very full account of these flies and their larvae. Up to the present only 4 species are known, and these are exceedingly closely related to one another:—*Auchmeromyia luteola, A.* (*Choeromyia*) *praegrandis, C. choerophaga* and *C. boueti*. The genus is confined to tropical and sub-tropical Africa. *A. luteola* has the widest geographical distribution, and is found from Senegal to the Sudan and down to the Cape. The author points out that its distribution coincides practically with that of the Negro and Bantu races, and that the fly is not found in the sub-tropical regions of the north inhabited by the Arabs and Berbers. *A. praegrandis* (*Cordylobia praegrandis*, Aust.) is known in Natal, Cape Colony, the north-west of Rhodesia and Nyasaland, and has been been met with by the author in French West Africa on the Upper Gambia, and by Bouet on the Upper Ivory Coast. The remaining species, *C. boueti* and *C. choerophaga*, are up to the present only known from the Western Sudan and the Niger Valley. The former species, which is certainly the least widely distributed, has only been found twice in the neighbourhood of Timbuktu and Niamey. The latter has been frequently met with, and though generally alone, sometimes in company with the former species, throughout the whole region of Timbuktu, Goa, Mopti and Djenna.

A. luteola is found in shady places about human dwellings, and appears to have a preference for the neighbourhood of latrines. The fly was observed to feed principally upon fallen fruit and dejecta generally early in the morning in cool weather or about sunset. Dr. Roubaud considers that the insect is constantly associated with man and lives more or less exclusively in his dwellings.

The adults of *Choeromyia*, on the other hand, are not dependent upon man, but live in the interior of the burrows of the wart-hog

(*Phacochoerus*) and ant-bear (*Orycteropus*), on which they are parasitic in the larval stage. If a stick be thrust some little distance into one of these burrows and struck against the walls, a large number of these flies will usually emerge. *C. boueti* and *C. choerophaga* live in the deeper parts of the burrows in complete darkness, and during the day never emerge unless compelled. The author says that after much patient watching he has never seen one fly come out voluntarily in the daytime, and when disturbed they soon return. Observations showed that they regularly leave the burrows at night.

Details are given of various experiments which show that *Auchmeromyia* has but a feeble resistance to heat, whilst *Choeromyia* can bear a temperature approaching 40° C., at least for a short time. The author also found that *Choeromyia* immediately sought out pads of cotton soaked in water or heaps of moist earth placed in the cage. The tendency of *A luteola* to seek moisture was not so marked. The adult flies feed upon sweet liquids and various juices, and especially on excrement. The author had no difficulty in cross-pairing *A. luteola* and *C. choerophaga* in either direction, but his observations led him to suppose that these crosses are invariably sterile. The process of oviposition is as follows:—The eggs are laid in the daytime in shady places, the female runs about on the surface of the soil in all directions dragging the extremity of her abdomen on the ground and making a furrow with it in the sand or dust. Her object being apparently to seek breaks, holes or cracks in the soil filled with loose earth, and having found one, she forces her abdomen deeply into it and deposits generally only one egg, very rarely more. She then recommences the process, and in this way spreads her eggs over the soil in the hut. Sometimes the eggs are laid round the natives asleep on the ground, but the fly was never observed to lay directly on their bodies or in the folds of their clothing. *Choeromyia* lays its eggs in the moist soil at the bottom of the burrows of the *Phacochoerus* and of the *Orycteropus* either singly or in small groups. The number of eggs laid is variable; the author noted the following in the case of females of *A. luteola*, 83, 71, 58, 30, 34. Oviposition begins about 14-15 days after emergence, and a second oviposition may take place as long as a month after the first one. The author experimented on a number of eggs with a view to determining the effect of temperature and moisture, and came to the conclusion that those of *A. luteola* are distinctly favoured by dry surroundings. When exposed to a temperature of from 32-48° C. two lots of eggs experimented upon were killed. In the case of *C. choerophaga*, however, dryness retarded hatching. The hatching of the larvae from the eggs is described, and the author says that 4 or 5 hours after birth, if placed upon the naked skin, they immediately attempt to bite. He points out that the position in which the eggs are laid in the burrows and other places must frequently compel the larvae to travel considerable distances before finding food. He therefore experimented upon a number of larvae and found that those of *A. luteola* were capable of living for 27 days after hatching without any food whatever, and those of *C. choerophaga* for 18 days.

The habitat par excellence of the larvae of *A. luteola* is sand and dust on the floors of native houses, and they can always be found by digging in the soil underneath a sleeping mat, provided that the natives sleep either directly on the soil or upon mats very slightly raised from its surface. The moment that the native raises his mat a very few centimetres above the soil the maggots disappear. In those cases in which the floor is strewn with loose earth the maggot abounds. The author cites districts in which this practice prevails, and says that in one such hut in which a dozen children were sleeping he captured 100 larvae in half an hour.

The fact that the wart-hog does not make its own burrows but occupies those of the ant-bear, probably accounts for the fact that *Choeromyia choerophaga* and *C. boueti* often occur together in the same burrow. Although no larvae of *C. praegrandis* were obtained, adult flies were found in the burrows of *Orycteropus senegalensis;* but in no case was *A. luteola* found in such situations.

The author describes in detail the manner in which the larva of *A. luteola* feeds and the process by which it fills itself with blood when once it has succeeded in producing a bleeding abrasion of the skin; it generally bites a man on his side and under the arm. The larvae can be raised experimentally upon the bodies of young pigs.

As a result of various experiments, the author concludes that the sensibility of the larvae to heat is dependent upon the need for food. For example, carefully conducted experiments with larvae placed in sand heated from above by a metal disc, showed that when the temperature rose to 31° C. starving larvae would move towards the source of heat, but beyond 38° C. the larvae tended to retire. But larvae which had been recently gorged did not move towards the source of heat, and when the temperature of the disc passed a certain degree they moved away from it. Experiments with larvae kept at a temperature of 35° C. showed that, in spite of feeding, death ensued about the 10th day. Growth was interfered with, and the larvae exhibited an abnormal activity.

The length of the larval life of these flies is of necessity somewhat difficult to determine, but according to the author's experiments, the results of which are set out at length, the growth and life of the larva is profoundly affected by food, and he found that under the best conditions of food and temperature *A. luteola* required 15 days before pupation, and that in this period two moults took place. Experiments were made on the effect of starvation and other conditions at the period of pupation, which tend to show that the date of pupation can be retarded by want of food, the larvae of *A. luteola* living 71 days and 76 days under these conditions before pupation took place. The author says with regard to the bite of these larvae, that the smaller they are the greater the pain, though this is in no case of any consequence, producing less irritation than the bite of a mosquito. In his own case, he found that the bites of about 20 larvae at the same time were not followed by either inflammation or itching. The bite of

C. choerophaga is much more painful than that of *A. luteola*, causing a circular patch of inflammation about 1 cm. in diameter around the bite; but the pain does not persist. On pigs these red spots may easily be observed and occasionally a slight flow of blood. So far as the author is aware these larvae have no pathogenic rôle; nevertheless the conditions of their life and their relations with man are such that it is possible that they may at times have some effect in this direction. He quotes the experiments of Dutton, Todd and Hennington in this connection.

The author next proceeds to discuss the anatomy of the larva of *A. luteola*. Pupation normally takes place 4 or 5 days after the last meal, and the pupal stage lasts for about 11 days, at a mean temperature of 63° C.

The final chapter of this paper is devoted to certain parasites of the fly, namely, a flagellate organism which is occasionally found in the intestine of *A. luteola* and a Hymenopteron, *Bembex olivata*, Dahlb., which is frequently to be found flying about the openings of the burrows of the wart-hog, and apparently regards *C. choerophaga* as its natural prey. The same fly has also been observed attacking *A. luteola*.

In an appendix a description is given of a new species of *Choeromyia* discovered by Dr. Becquaert at Katanga. From the little which is at present known of its habits, it would appear to behave somewhat after the fashion of *C. praegrandis;* that is to say, it is not so rigorously confined to burrows during the daytime as the other species.

A bibliography concludes the paper.

NEIVA (Dr. A.) & DE FARIA (Dr. G.). **Notas sobre um caso de miiase humana ocasionada por larvas de *Sarcophaga pyophila*, sp. n.** [Notes on a case of human myiasis caused by larvae of *Sarcophaga pyophila*, sp. n.]—*Memorias do Instituto Oswaldo Cruz, Rio de Janeiro*, v, no. 1, 1913, pp. 16-23.

In Brazil the flies most frequently causing human myiasis are *Chrysomyia macellaria*, F., and *Dermatobia hominis*, L. Usually, physicians neglect to rear the larvae from such cases, which accounts for the fact that myiases caused by *Sarcophaga* are little known. The species causing cutaneous myiasis are *S. carnaria*, *S. magnifica*, *S. latifrons* (Europe), *S. ruficollis* (India), *S.* sp. (Guiana), *S. lambens* and the new species discovered by the authors, *S. pyophila* (Brazil).

The last-named species was bred from larvae found in a suppurating contusion in the right parietal region of a girl (10). The suppuration had been favoured by the long hair.

The authors believe that a case of myiasis of the external genital organs described by Dr. O. de Lima (Medicina Militar, R. de J., no. 2, 1910, pp. 113-117) as having been caused by *S. magnifica* was really due to *S. wohlfahrtia*.

Neiva (Dr. A.). **Informações sobre a biologia da Vinchuca, *Triatoma infestans*, Klug.** [Notes on the biology of the Vinchuca, *Triatoma infestans*.] — *Memorias do Instituto Oswaldo Cruz, Rio de Janeiro*, v, no. 1, 1913, pp. 24-31.

Dr. Oswaldo Cruz received living specimens of the "vinchuca" from Chile, Argentina and Brazil (Rio Grande do Sul, São Paulo) and handed them to the author for observation. In the Spanish-American countries this bug is known as the 'vinchuca,' in Brazil as 'barbeiro' (São Paulo and Minas) or 'fincão,' 'chupão' (Rio Grande). The author quotes Darwin's graphic description of the blood-sucking habits of this bug and the observations of Klug, Poeppig and Berg. He cannot endorse Fairmaire's view that its bite causes an uncomfortable swelling. The bug is a great nuisance all over South America.

The larvae were observed to engorge themselves in 5 minutes, the nymphs in 10, and the adult vinchuca in 20 minutes. Intervals without food may be of a duration of 4 days to many months. The adult usually feeds once a week; if the last meal was small, some specimens fed daily, but for about 10 minutes at a time only.

In northern Brazil *Triatoma brasiliensis*, Neiva, a closely allied species, takes the place of *T. infestans*, which is not found near the equator.

Neiva (Dr. A.). **Notas hemipterologicas.** [Notes on Hemiptera.] —*Memorias do Instituto Oswaldo Cruz, Rio de Janeiro*, v, no. 1, 1913, pp. 74-77.

A discussion of the systematic position of the bug *Belminus rugulosus*, which the author asserts to be identical with *Conorhinus diminutus* and for which the correct designation appears to be *Triatoma rugulosa*, Stål (1859).

Lutz (Dr. A.). **Contribuiçao para o estudo das Ceratopogoninas hematofagas do Brazil.** [Contributions to the study of the blood-sucking Ceratopogoninae of Brazil.]—*Memorias do Instituto Oswaldo Cruz, Rio de Janeiro*, v, no. 1, 1913, pp. 45-73, 3 pls.

Descriptions of 15 species of blood-sucking Ceratopogoninae, of which 13 are new, the majority belonging to the genus *Culicoides*. The wings of all the species are shown in the plates, also the adult *C. reticulatus*, sp. n., and *Tersethes brasiliensis*, sp. n., the eggs and nymph of *C. marium*, sp. n., and the palpi of several species.

Campbell (C. A. R.). **The Eradication of Mosquitos by the Cultivation of Bats.**—*Monthly Bull. of Agric. Intelligence and Plant Diseases, Rome*, iv, Aug. 1913, pp. 1175-1181, 2 pls.

In this communication made to the International Institute of Agriculture, Rome, the author says that bats are the greatest enemies of mosquitos and he considers that they should be cultivated and utilised for mosquito reduction. He says that bats are probably immune from the bite of a mosquito, firstly because of the peculiar formation of the hair covering their bodies and secondly because of their peculiar odour. He points out that bats are remarkably free from disease and that this is shown by the fact that although they live in caves in vast numbers, touching one another and even hanging to one another, yet men engaged in collecting bat guano very rarely find a dead bat.

The author has made observations in a hunter's cabin 10 miles from San Antonio (Texas) where bats were congregating. He spread large white sheets on the floor about 4 o'clock in the morning and so prepared the roosting places in the hut that bats could not roost except above the sheets. The bats were counted in and counted out and the guano collected, with the result that the latter averaged 26 pieces to each bat. From this and other data similarly obtained he estimates that a structure large enough to hold 500,000 bats would cost considerably less than £2,400 and that they would yield in a year 20¼ tons of guano of an average value of £121 10*s*. He then proceeded to construct a bat roost from his own design in a place near San Antonio notorious for mosquitos. The roost was finished in April 1911; in August he estimated that several hundred bats required 20 minutes flying in one constant stream to enter the roost. In 1912 the numbers in the roost were so great that it took them several hours to come out. A short time before making this communication to the Institute he made inquiries of the heads of 14 families and all declared that the mosquitos last year were very much less than the year before and that fever had almost vanished. Others said that before the roosts were erected the cattle were very thin and poor, in spite of the good food, which was attributed to worry by mosquitos; and the workmen engaged on irrigation work close by previously complained of being sometimes driven away from their work by the mosquitos, but were now scarcely troubled by them. The duck-hunters also remarked that the mosquitos had greatly diminished. The author concludes from these observations that it is not only commercially, but hygienically, profitable to cultivate bats.

Laveran (A.) & Franchini (G.). **Infections expérimentales de la souris par** *Herpetomonas ctenocephali*. [The experimental infection of mice with *Herpetomonas ctenocephali*.]—*C. R. hebd. Acad. Sci., Paris*, clvii, no. 9, 1st Sept. 1913, pp. 423-426.

The authors state that the number of *Ctenocephalus canis* infected with *Herpetomonas* varies considerably, according to the place of origin of the fleas. Of 23 fleas taken from dogs in a kennel at the Institut Pasteur 12 were infected, whereas of 30 fleas taken from young dogs recently placed in the same kennel none were infected. In 1912 Lafont recorded that if mice were inoculated with trypanosomids from the intestine of *Conorhinus* *rubrofasciatus*, a blood infection of short duration took place. The authors proved the same to be the case with the *Herpetomonas* of the dog flea, only that the infection persisted in the mice for 36, 42 and 61 days after inoculation. The authors results are of interest in relation to the question of the transmission of kala azar.

TAUTE (Dr. M.). **Untersuchungen über die Bedeutung des Grosswildes und der Haustiere für die Verbreitung der Schlafkrankheit.** [Investigations regarding the rôle of big game and of domestic animals in the transmission of sleeping sickness.]—*Arb. Kaiserl. Gesundheitsamt, Berlin*, xlv, no. 1, August 1913, pp. 102-112, 1 pl.

In view of the divergent opinions of Kleine, Kinghorn and Yorke, and Bruce regarding the rôle of big game as reservoirs of sleeping sickness, the author decided to make independent investigations in Portuguese Nyasaland, not far from Lake Amaramba and 90 kilometres east of Fort Johnston. At Lubimbinu a small fly-free area was discovered, surrounded by a broad forest belt containing an abundance of tsetse-fly and big game; in addition to *Glossina morsitans*, TABANIDAE are very numerous during the rainy season.

The population is more or less congregated in large villages where *G. morsitans* is very common. Nevertheless, the author was able to confirm the observations of British Medical Officers along the Anglo-Portuguese boundary in that while malarial parasites were frequently found in the blood of natives, human trypanosomiasis is absent. Cattle and sheep, however, do not exist in the district, a few isolated goats are found in localities on the borders of the fly-free area, and dogs are rare and rapidly succumb.

The laboratory animals were procured from fly-free areas and transported to Lubimbinu in fly-proof receptacles. Similar precautions were taken during the quarantine, and later in camp, the animals in question being dogs, long-tailed monkeys, wild rats, and, to a limited extent, goats. Experiments on the pathogenicity of cattle were made on British territory near Fort Johnston.

In the afore-mentioned *Glossina* belt 37 specimens of big game (buffalo, eland, sable antelope, waterbuck, Lichtenstein's hartebeest, bushbuck, reedbuck, duiker, warthog and bushpig) were killed between August and December 1912, and in 25 cases monkeys and dogs, and in three cases goats, were inoculated with the blood. Trypanosomes, closely resembling *T. rhodesiense* in appearance and in their pathogenic effect on *animals*, were found six times. Other trypanosomes found in the antelopes probably belong to the *T. vivax* and *T. pecorum* group.

In 369 wild *Glossina* captured at a certain distance from the camp 69 (18·7 per cent.) contained mammalian blood and 27 (7·3 per cent.) showed mammalian trypanosomes. In this district, with an abundance of game, the flies hardly feed on cold-blooded animals.

Altogether 1,069 *Glossina* were fed once in groups of 30 to 163 on eight clean dogs and two monkeys, and six of the animals showed trypanosomes of the dimorphic type with nuclei at the posterior end, after an incubation of from four to six days.

The high percentage of infective flies was also shown by blood smears of domestic animals (dogs and goat) in the fly area.

The trypanosomes from the antelopes and from the naturally infected domestic animals closely agree with each other and with *T. rhodesiense*, both morphologically and as regards pathogenicity. If the views of Kinghorn and Yorke were endorsed, this would mean that 16·2 per cent. of the big game and the same relative number of domestic animals would be reservoirs of human sleeping sickness.

The author's experiments, however, show that this opinion is untenable. *Glossina morsitans* reared from the pupae were fed for the first four days on a monkey heavily infected with trypanosomes from antelopes, after a day's fast they were then fed consecutively on four goats (6th-12th, 13th-16th, 17th-19th and 20th-22nd day), on a monkey (23rd-25th day), on two dogs (26th-27th day), on the author (28th-32nd day), on a monkey (33rd-35th day), and on two dogs (36th-40th, 41st-44th day). The first three goats remained in good health; the fourth goat suffered from trypanosomiasis and died after 20 days, the monkey died after 25 days; the two dogs showed blindness and keratitis and died after 19 and 20 days respectively; *the author remained in good health*; the monkey died after 14 days' illness; the last two dogs died after eight and 21 days. With the exception of that of the author, the blood of all the animals showed typical trypanosomes with posterior nuclei.

A similar experiment was made with the following sequence of subjects consecutively inoculated by flies: monkey, goat, dog, goat, five dogs, the author, two dogs, with identical results regarding the immunity of man.

In a third experiment the author injected the blood of a dog badly infected with trypanosomes by natural means, in quantities varying between 0·25 and 2 cc., subcutaneously into monkey, three dogs, goat, two rats and himself (2 cc.). All the animals after a period of incubation of three days showed severe trypanosomiasis and died in from 12 days (monkey) to 22 days (rat). The author remained absolutely and permanently well.

The big game trypanosomes, therefore, in spite of being apparently identical with *T. rhodesiense*, must be referred to *T. brucei*, especially in view of the recent results of Wenyon, Blacklock, Kleine and Fischer.

In order to settle the question regarding the infectivity of *T. brucei* for man, the author injected subcutaneously altogether 90 cc. of his blood, a fortnight after inoculating himself with the blood of the dog in the previous experiment, into a monkey and seven dogs. The animals remained perfectly well, so that he regards it as certain that *T. brucei* does not find conditions favourable to its existence in human beings.

Strickland (C.). **Short Key to the Identification of the Anopheline Mosquitos of Malaya.**—*Kuala Lumpur, F.M.S.*, 1913, 15 pp., 6 pl.

This key, which is intended specially for the use of medical officers, comprises 15 species. The specific characters are clearly illustrated by diagrams, and the key is prefaced by hints on methods of examination.

Parasitic Mange in Horses, Asses, and Mules.—*Leaflet No.* 274, *Board of Agriculture and Fisheries, London*, July 1913.

This leaflet contains a popular description of the parasites and states that the larvae issue from the eggs from 4 to 7 days after laying. The mites can exist on moist dung for several weeks, but live for a shorter time on a dry surface. The eggs are said to retain their vitality for several weeks if moisture be present, but only from 3 to 6 days in a dry atmosphere. The parasites are killed by a temperature of 104° F. or over, but moderate warmth, such as obtains in warm stables and during summer, stimulates them and renders them more active.

Three varieties of parasitic mange affect horses, asses, and mules:—sarcoptic, psoroptic and symbiotic. Each is caused by a special mite, which has a characteristic mode of life. The sarcoptic form spreads slowly, but is the most difficult to cure. The parts attacked first are generally those which come in contact with the saddle or other harness. The psoroptic form spreads rapidly and is more prevalent than the sarcoptic. It is at first usually confined to those parts of the body on which the hair is long, such as the neck, withers, rump and the base of the tail, but in neglected cases spreads all over the body. The symbiotic form is perhaps the most prevalent, but not so serious as the two former. It is generally confined to the extremities of the leg, but may also affect the tail. It develops slowly and only exceptionally invades other parts of the body. An animal may harbour more than one form of mange at a time.

The symptoms are described at length and attention is drawn to the fact that in the case of symbiotic mange the horse may do serious injury to its limbs, particularly to the coronet, by bruising it with the opposite foot in making attempts to relieve the itching. Parasitic mange is essentially contagious and may be spread directly from one animal to another or indirectly by means of litter, rugs, bandages, grooming tools, harness, stalls, stablemen and their clothing and stable utensils. The parasite may live off the animal for some weeks in harness, litter, etc., and care should be taken in the loan or exchange of harness or the use of secondhand harness. The disease may also be picked up on board-ship, at sales, in railway trucks and from the shafts of carts. Low condition and neglect of grooming greatly favours the development and spread of the disease, so that internal remedies given with a view to improving an animal's general health are useful adjuncts to external treatment. The leaflet concludes with a recital of the Parasitic Mange Order of 1911.

Martoglio (F.). **Sulle tripanosomiasi del dromedario eritreo.** [On trypanosomiasis in the Eritrean dromedary.]—*Annali d'Igiene Sperimentale, Turin,* xxiii (N.S.), part 2, 1913, pp. 229-234.

The author finds that in Eritrea, trypanosomiasis of camels is of two kinds, one due to the same trypanosome which causes bovine "jahan" (*cf.*, vol. xv., p. 1); the other, called by the natives "atteh," being caused by an entirely different trypanosome. Both diseases attack other domestic animals besides the dromedary. They are generally contracted in the lower districts, and when they appear on the plateau they invariably do so in confined areas, such as deep valleys. They appear to be absent from the sandy and barren seashore, and the infected localities begin as the ground rises on the lower slopes of the plateau, where woods and streams cool the air. Both forms spread towards the end of the rainy season and during the period immediately following it, while there are generally no new infections during the dry season.

The "jahan" is transmitted by a *Stomoxys.* Its range is limited, and it is chiefly found in horned cattle, though horses, sheep and camels are equally subject to it. A dog having been inoculated with virus from a dromedary, the parasites disappeared after a few days, and its blood was found to be innocuous to horned cattle, even when injected in large quantities. The disease in the dromedary, propagated by the same fly which gives "jahan" to horned cattle is called "gud-ho" or "gudū" by the Beni Amer and all the tribes speaking the Tigrē dialect. In many cases it is acute, and is then fatal in two or three weeks, while in the chronic form the chances of recovery increase with the length of resistance. Cured animals are liable to relapse if weakened again by overwork, murrain or other causes. Dogs, rabbits, rats and field-rats are not susceptible to experimental inoculation, and even in very young animals, in which the organism sometimes obtains a footing, it soon disappears completely.

The other trypanosomiasis of the dromedary, termed "atteh" by all Eritreans whose speech is Tigrē, appears to be transmitted by Tabanidæ (*Hæmatopota* or *Pangonia*). Woods near torrents or pools are very dangerous; but the disease can be contracted in the height of the rainy season all over the lower and middle districts. One of the infected mules was, moreover, supposed not to have left the plateau for some time; yet the plateau is not feared at any time by camel-drivers. Infection takes place from dawn to sunset. In dromedaries it is chronic, and the few deaths due to it generally take place within a year, cured animals being immune; in horned cattle it is often fatal, at the end of seven or eight months, to young beasts, while the blood remains infective long after the cure; in horses it may produce fatal prostration; in sheep, recovery is the rule, the blood remaining infective a long time after it; in dogs it is usually fatal, as also in rabbits, rats and field-rats. The "atteh," which belongs to the *surra* group, greatly resembles the trypanosomiasis of the Somali dromedaries, called "salaf" (*op. cit.*, vol. xxi., p. 453).

An easy way of differentiating the two kinds of Eritrean trypanosomiasis is by inoculation of a full-grown dog and a sheep. The dog will remain perfectly healthy if inoculated with "jahan," but will fall seriously ill if "atteh" be transfused; "jahan," on the contrary, will cause the sheep's death in a few days, while "atteh" will leave it nearly normal.

La chasse aux Mouches et les Fumiers. [The destruction of flies in relation to manure heaps.]—*Le Moniteur d'Horticulture, Paris*, no. 17, 10th Sept. 1913, p. 194.

In an editorial, attention is drawn to a circular, issued by the French Ministry of Agriculture to the Directeurs des Services Agricoles Départementaux, enjoining them to take such steps as may be possible to spread a knowledge of the harm done by flies to human beings and simple methods for their destruction, more especially the destruction of the larvae in manure heaps by the use of petroleum, cresyl and other active disinfectants. It is pointed out that the lavish use of these disinfectants, though fatal to the flies and their larvae, renders the manure unfit for garden use and especially for the cultivation of plants in frames laid upon hot-beds of such manure; and it is said that it has been experimentally proved in the neighbourhood of London that manure which has been treated with disinfectants regardless of quantity, is unfit and even harmful for such methods of cultivation. The writer of the article says that milk of lime, small quantities of sulphate of iron or alkaline solutions may be employed without spoiling the manure, but that all petroleum derivatives and the like should be proscribed.

Fleming (Dr. A. M.). **Trypanosomiasis in Southern Rhodesia.**—*Trans. Soc. Trop. Med. & Hyg.*, vi, no. 8, July 1913, pp. 298-310, 1 map.

The author considers that in view of the erroneous impressions which prevail on the distribution of sleeping sickness in Southern Rhodesia, it is desirable to give a somewhat detailed account of it and of the distribution of the fly.

The only variety of *Glossina* found in Southern Rhodesia is *G. morsitans*, and its habitats are limited in area. The fly-areas are small in extent, as compared with the country. They lie in the northern part of the territory and are widely scattered, thus differing from the distribution of the tsetse in Central and Equatorial Africa. Our knowledge of the bionomics of the fly is still too limited to supply any satisfactory explanation as to why the tsetse should be confined within these somewhat arbitrary boundaries, when topographically and climatically there are stretches of country to all appearance similar, for it may be that tsetse will be found on one side of a range of hills, whilst on the other side none has been known within the memory of the oldest inhabitant.

After the outbreak of rinderpest in 1896, the fly-belts in Southern Rhodesia underwent an extraordinary shrinkage, whilst in many districts fly disappeared altogether. It must be confessed that since then fly has shown a tendency in some places to spread back to its old boundaries, but *not beyond*, whilst in others, fly has not reappeared at all, and this is specially noticeable on the Pungwe Flats, and the stretch of country between the Portuguese border and the coast on the east.

The scattered nature and limited extent of these fly-infested areas materially reduces the danger of any serious spread of sleeping sickness in Southern Rhodesia and moreover renders its occurrence of secondary importance, for these areas are, in almost all instances, remote from European settlement, and are only sparsely populated by natives. The removal of persons from any fly-infested area would therefore not be a difficult matter at any time should the necessity arise.

The author, in conjunction with Dr. F. O. Stöhr, Mr. Carbutt and Mr. Jack, carried out an investigation of the fly area in the Sebungwe district, in order to ascertain if any cases of trypanosomiasis existed amongst the natives. They examined every individual who could be found, including men, women and children, and as a result 12 cases were recorded. Tsetse-fly was encountered or reported to exist by natives over an area roughly 70 miles east and west, and 40 miles north and south, and stretching from the Nagapandi River on the west to a point some 20 miles to the east of the Sengwe River on the east, and from the Sijalila Hills on the north to the Mzola River on the south, roughly an area of 4,000 square miles. At Kariyangwe, which was the Government station of the district, fly was reported as having been seen on several occasions, but the investigators saw none during their visit. Fly was first met with at Simasu's on the Lubu River, some 5 miles to the east of Kariyangwe, and from there onward along the route followed it was fairly plentiful.

The relationship of fly to game in this area is somewhat difficult to follow, and its distribution would appear to be more influenced by geographical features than by the movement of game.

The natives within the fly-belt have no cattle, few dogs and only small herds of sheep and goats, and in most cases a certain percentage was found to be infected with trypanosomiasis, and rabbits were successfully inoculated from human beings, dogs and goats. Though infected sheep, dogs and goats were almost generally distributed throughout villages in the fly-belt the author says that it is interesting and probably important to note that almost all human beings found to be infected were either resident within, or previous to the period of infection had visited, a certain small area of country which is situated on the Busi River, a tributary of the Sengwe, the natives in these villages having little communication with those of villages in other parts of the district. The extent of infection is small considering the total native population and the fact that natives are freely bitten by tsetse in their lands and around their villages.

There is some difficulty in believing that the trypanosome which affects man in this limited area is the same as that found in sheep and goats in other parts of the fly-area. Sheep and goats have always died between the months of November and April after varying periods of illness and small stock have never existed over two rainy seasons, while the infection of human beings, if not of recent origin, is at any rate even now extremely sporadic. The frequent wholesale destruction of herds of small stock would presuppose a periodical heavy infection of fly.

A brief description of the character of the country in the fly-belt is given and the author states that about Manzatuba in the north-east, which is considered the highest point, is strangely enough the place at which the largest number of tsetse are to be found. He says that it is a much argued point whether fly will disappear with the disappearance of game, but any scheme for the extermination of fly within the small fly-belts of Southern Rhodesia should include either the extermination or the driving back of game. He is of opinion that more would be gained by deforestation from without inwards, breaking up large tracts of ground and putting it under cultivation.

Theiler's observations in Zululand, Egypt and Uganda raise a doubt in the author's mind as to whether *Trypanosoma rhodesiense* can any longer be regarded as a specific trypanosome dangerous to man, transmitted by *Glossina morsitans*, and existing only in Northern and Southern Rhodesia and Nyasaland.

Dr. H. A. MacKenzie travelled through the adjacent fly-belt on the Umniati River, which is 60 miles long by 40 miles broad and has a total population of 600 natives. He found no cases of human trypanosomiasis and only one sheep infected. Dr. Stöhr investigated the fly-belt to the north of the Lomagundi district and failed to find any cases in human beings.

A medical Station was established at Fundu for the examination of natives travelling south who were detained under medical supervision for 14 days, and last year 7,000 passed through the station and no case of sleeping sickness has been reported in any Southern Rhodesia mine nor among any Southern natives working elsewhere in Southern Rhodesia.

The present policy for dealing with trypanosomiasis in the Sebungwe district is to remove all natives from this and the adjacent fly-belt on the Umniati to fly-free areas, which steps will check further local spread of the disease. As regards dealing with the fly, the eventual policy is not yet decided, but it is proposed for a start to withdraw the game laws for the area lying to the east of the Sengwe and west of the Umniati rivers, and to throw the country open for shooting. The reduction of game in this area will prove a criterion as to whether in consequence of this the borders of the fly-belt can be limited, or the fly driven back.

CRIDDLE (N.). **Insect Pests of Southern Manitoba during 1912.** —*Ann. Report Entom. Soc. of Ontario, Toronto,* 1913, pp. 97-100.

The author records an unprecedented outbreak of *Stomoxys calcitrans*, which not only caused great annoyance to horses and cattle, but also rendered the ears of dogs quite raw. On the other hand even single individuals of the horse fly were rare. The usual mosquitos, house flies and less important pests maintained normal proportions.

JOYEUX (Ch.). **Biologie de** *Cimex boueti.* [The biology of *C. rotundatus* (*boueti*).]—*Archives de Parasitologie, Paris,* 15th April 1913, pp. 140-146, 8 figs.

The author says that *Cimex rotundatus* is found in various parts of the French Sudan, at Buaké on the Upper Ivory Coast, in Upper Guinea, at Gao, near Timbuktu, more northward at Jenné, at Wagadugu, in Upper Dahomey, at Kankan and at Beyla; its south-western limit seems to be Kurussa, where *C. lectularius* also occurs. Their bite is much the same in its effects, but *C. rotundatus* has not the odour characterising the other. It has a number of hosts, such as man, mice, rats, &c., but in one case a whole brood succumbed when fed on a white mouse, though neither the insects nor the mouse showed anything abnormal and the latter was afterwards used successfully to bring up many other broods. No parasites of any kind were found in *C. rotundatus*, for *Trypanosoma cruzi*, known to infest it elsewhere, has not appeared in Africa.

The insect merely increases in size during its five moults, which, like the incubation of the eggs, last a longer or shorter time according to the weather, being more rapid in Upper Guinea in March, April and May, the hot season, than during the rest of the year. The females are fecundated after the fifth moult and lay a decreasing number of eggs after each subsequent meal; life is shorter than that of the males, which may last 4 or 5 months; and the insects, as they grow older, can remain a longer time without food, varying from 15 to 42 days.

MALTESE (P.). **Educazione Antimalarica e Profilassi Antimalarica Scolastica nella Provincia di Trapani.** [Education concerning Malaria and its Prevention in the Schools of the Province of Trapani.]—*La Propaganda Antimalarica, Naples,* no. 2, 30th April 1913, pp. 37-45.

The author relates in detail how the use of quinine in the elementary schools at Salemi reduced the proportion of malarial fevers from 40·9 per cent. in 1906-7 to 1 per cent. in 1911-12. He goes on to describe the lectures given to elementary teachers at Salemi and Trapani, with the aid of statistical tables, maps representing the distribution of malaria throughout the world, and illustrations showing the effects of the disease, the appearance of the *Anopheles*, the nets, gloves, &c., to be used as protection, and the like. Examinations followed, certificates were presented to those passing them, and it is proposed to continue in the same direction, gradually educating the whole population to adopt the necessary measures for combating the disease.

Wood (E. J.). **Some Problems in the Etiology of Pellagra.**—*Interstate Med. Journal, St. Louis*, no. 5, May 1913, pp. 437-442.

The author contends that the relation to pellagra of Indian corn, largely eaten in the Southern States, for instance, by the comparatively immune negro, cannot be established; and he urges that in Carolina, as in Italy, the disease " exactly conforms with the kind of water and land which is invariably selected by the *Simulium*." This, however, he believes to be *S. vittatum* in the United States, not *S. reptans*. Women are more frequently attacked than men, a fact which throws a doubt upon the insect being the cause, since it is a field pest, to which men are more exposed. The author adds that uncinariasis is the greatest lowerer of resistance to pellagra, the cause of which is still an open question, and should be investigated without preconceived notions.

Robinson (G. H.). **The Rats of Providence (R.I.) and their Parasites.**—*American Journ. Pub. Health, New York*, Aug. 1913, pp. 773-776.

The outbreak of plague in the West Indies in 1912 led to an extensive examination of rats in Providence. From July to January 341 rats were examined, and of these 195 were infested with 2053 fleas, 75 per cent. of them being *Xenopsylla cheopis*, Roths., and 22 per cent. *Ceratophyllus fasciatus*, Bosc, 2·5 per cent. *Ctenopsyllus musculi*, Dugès, and 0·5 per cent. *Ctenocephalus canis*, Curtis. Of the rats, equally divided as to sex, 333 were *Mus norvegicus*, 2 *M. alexandrinus*, 4 hybrids between them, 1 *M. rattus* and 1 cross between it and *M. norvegicus*. The fleas were distributed with comparative uniformity all over the bodies of the rats, but the cold weather created a slight migration towards the more thickly furred pectoral and pelvic regions. The average between July and September was 10·2 fleas per rat and from October to December 3·7, and the mean in clean places was higher than in docks, stables and the like, where the insects probably remain in the nests of the rats except when actually feeding. *Laelaps echidninus*, Berl., found on 21 per cent. of the rats, increased during the cold weather. *Polyplax spinulosus*, Burm., was met with on 24 per cent. and one specimen of *Myonyssus decumani*, Tirab., was discovered. There were no plague germs either in the animals or in the fleas, and the liver disease in 7 per cent. of the rats was due to tapeworm and similar parasites.

Heckenroth (F.) & Blanchard (M.). **Note sur la présence et l'endémicité d'une myiase furonculeuse au Congo français.** [On the existence and endemic character of furuncular myiasis in the French Congo.]—*Bull. Soc. Path. Exot., Paris*, 14th May 1913, pp. 350-351.

The researches of the authors and others have shown that in French Equatorial Africa the "Cayor worm" and allied species are rare. One case, however, was discovered at Nola in 1907, when a European was parasitised by two larvae in his left arm; now others have been reported from Sembe in N'Goko, where two Europeans and a native woman living in the vicinity were simultaneously attacked, and 13 larvae in all were extracted. In no case were the flies bred out, but it is believed that the species was *Cordylobia rodhaini*, Gedoelst, rather than *C. anthropophaga*, Grünb. The former has hitherto only been observed in the Belgian Congo, especially about Leopoldville.

Franchini (G.). **Sur un protozoaire nouveau parasite de** *Anopheles maculipennis*. [A new protozoal parasite of *A. maculipennis*.]—*C. R. Hebd. Soc. Biologie, Paris*, 13th June 1913, pp. 1196-1198, 18 figs.

The author has given the name of *Baccellia anopheliae*, g. n., sp. n., to a parasite not previously discovered and apparently very rare, the complete evolution of which seems to take place in the digestive tube of *Anopheles maculipennis*. The figures show the division of the free parasite into karyosomes, the various forms of multiplication and the encystment.

Rouché (Dr.). **Note sur une Épidémie de Dengue à bord de la "Manche" en 1911.** [An Epidemic of Dengue fever on board the "Manche" in 1911.] — *Archiv. Méd. & Pharmacie Navales, Paris*, June 1913, pp. 450-461, 2 tables.

The author begins by recapitulating the previous epidemics on board the despatch transport the "Manche," on which 114 out of 127 Europeans were attacked by dengue fever in 1906, 94 out of 108 in 1907, and 2 in 1908, when the disease was circumscribed from the outset. In 1911 there were 91 cases among 126 Europeans. On each of these occasions the Annamite lascars, of whom there were 34 in 1911, remained completely immune, as did also all the Europeans who had been attacked before. The origin of the outbreak cannot be determined. The "Manche" left Saigon, the chief centre of dengue in Indo-China, on 17th August 1911, stopped for 24 hours in the Bay of Cam-Ranh, went on to Nhatrang, another centre, remained there till 18th September, and arrived at Tongking on the 24th, having put into Turan Bay for 24 hours on the way thither. The first case broke out at Nhatrang on 6th September, the last at Haiphong on 3rd November; and during the whole outbreak the ship was filled with mosquitos. A ship affords so many entrances and breeding places that mosquito nets appear to be the only effective protection. The author states that at the beginning of the outbreak the fever was believed to be paludal.

BRUMPT (E.) & GONZALEZ-LUGO. **Un Réduvide du Vénézuela, le** *Rhodnius prolixus*, **chez lequel evolu** *Trypanosoma cruzi*. [A Venezuelan Reduviid, *Rhodnius prolixus*, host of *Trypanosoma cruzi*.]—*Bull. Soc. Path. Exot., Paris,* 11th June 1913, pp. 382-383.

The authors describe the results obtained from *Rhodnius prolixus*, called in Venezuela "Chivo" or "Chinche de monte," taken from farm labourers' houses near Valencia (Venezuela). Three larvae artificially hatched evacuated no flagellates after a non-infectious meal on 23rd March 1913, an indication that infection is not hereditary. On 1st April a second meal was given on a monkey (*Cercop. patas*) naturally infected with *T. cruzi* (Bahia virus). On the 19th the evacuations contained trypanosomes, with which a young rat was normally infected by inoculation in the peritoneum, and on the 9th June the infected evacuations still continued. On 13th May a live imago, one of a batch just received, was dissected, and the evacuations of several unfed nymphs were examined, but no trypanosomes were found. On 10th June an adult fed upon a guinea-pig remained uninfected, while two nymphs evacuated trypanosomes and *Crithidia*. As the guinea-pig had previously often been bitten and fouled by *Conorrhinus megistus*, without, however, showing any signs of *T. cruzi*, it remains to be seen whether the infection was brought from Venezuela by the insects or was chronic in the guinea-pig, or accidentally contracted by it. If *Rhodnius* remains indefinitely infective, like *Conorrhinus* and not for a few months only, like *Cimex lectularius* and *C. rotundatus*, it is likely to prove more dangerous; for *Conorrhinus* rarely evacuates until after a meal, whereas *Rhodnius* larvae and nymphs do so immediately after drawing out the rostrum, leaving excretions on the skin from which the trypanosomes might make their way through the dermis or be introduced by scratching on the part of the patient. *Rhodnius* is common in parts of Venezuela, Colombia and the neighbouring countries.

MARZOCCHI (V.). **Sur le** *Phthirius inguinalis*.—*Archiv. Parasitologie, Paris,* 10th July 1913, pp. 314-317.

As the result of a number of experiments, the author has found that *Phthirius inguinalis* lives apart from its natural host, under favourable conditions, from 10 to 12 hours, and less if they are not propitious; that the eggs do not hatch between 18° and 20° C. (64° to 68° F.), and that the insects hatched between 30° and 32° C. (86° to 90° F.) only survive their birth for a very short time, which the author was unable to determine exactly.

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Legislation to prevent the introduction of Fowl Ticks into Australia.—*Commonwealth of Australia Gazette*, no. 57, 16th August 1913.

The importation of fowls from Asia and the East Indies into the Northern Territory of Australia is prohibited by proclamation, owing to the danger of introducing fowl ticks and other pests or diseases.

Tick-bite.—*Journ. Trop. Med. & Hyg., London*, 16th June 1913, pp. 188-189.

Epitomising contributions by Eaton, Cleland and others to the "Australasian Medical Gazette," the Journal describes the symptoms of a girl aged 4½, in whom a bite of *Ixodes ricinus* or *I. holocyclus* was followed by a widespread transitory muscular paralysis; adding that bites of ticks causing severe, and sometimes fatal, intoxication in the human subject have been recorded on other occasions in Australia, the symptoms greatly resembling those of conium poisoning. These bites often also cause the death of lambs and dogs, muscular paralysis first affecting the limbs, and death from respiratory paralysis ensuing. The source of the poison has not been established, but it is believed not to be pre-formed in the glands of the tick.

BELLILE (P.). **Etude sur la Fièvre des Phlébotomes.** [A study of Phlebotomus fever.]—*Archiv. Méd. & Pharmacie Navales, Paris*, July 1913, pp. 5-39, 5 tables, 3 figs.

After reviewing the observations made in various parts of the world with regard to pappataci fever and *Phlebotomus papatasii*, Scop., from Pyne's discovery in 1804 onwards, the author goes on to describe his own experiences in Suda Bay in 1910-1912, during the dry summer season extending from the middle of May to the end of September, which confirm the results obtained by Kilroy. The fever was not confined to the island at the entrance to the bay, for there were several cases among the natives in Suda village, where the mess cook of the French warship "Amiral Charnier" and his wife were also attacked, while two French sailors at the arsenal and a Cretan doctor were among those who took the fever elsewhere. The Italian bluejackets who landed on the island and who were provided with nets, invariably remained immune. The author suggests portable nets to cover the exposed parts of the body after nightfall, and netting on all openings in buildings; but in either case the network must be much finer for *Phlebotomus* than for mosquitos. The fact that the illness is only found during the dry season, and that the larvae hide in the crevices of walls exposed to the sun, points to the watering of such crevices as a means of destroying the insects. The Italian sailors landed from one vessel are said to have smeared their bodies with petroleum ointment that the smell might drive the insects away. Fumigation is a palliative of small efficacy.

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Legendre (J.). **Note sur les Stegomyias du Tonkin.** [On *Stegomyia* in Tonkin.]—*Bull. Soc. Path. Exot., Paris,* 9th July 1913, pp. 511-513.

Stegomyia in Tonkin, though most abundant in summer and autumn, is also met with at other seasons, appearing even in February, the coldest month. It is more active by day than by night, the males sucking up perspiration and the females drinking blood. The insect finds the naked legs of children an easy prey. Its habits are the same as in Africa and America. It oviposits in clear water, *e.g.*, in ricefields, in the neighbourhood of man, and it sometimes chooses such receptacles as the water in empty snail-shells, cut bamboos, etc. The eggs were found in the fork of a tree at Hanoi, but several visits to a "travellers' tree" (*Ravenola madagascariensis*) close by, failed to disclose any.

Legendre (J.). **Destruction des Culicines à l'aide du gîte-piège.** [The destruction of Culicidae by the use of breeding places as traps.]—*Bull. Soc. Path. Exot., Paris,* 9th July 1913, pp. 513-514.

The author states that at Hanoi the tropical showers and gusts of wind peculiar to the five months of the hot season greatly interfere with the laying of eggs by Culicidae, especially when the squalls take place about or after nightfall; and he gives a table showing the numbers of mosquitos observed at the Biological Station during various months, adding that the multiplication of the insects takes place in March, April and May. During stormy weather they have to lay in clear water, such as that in household vessels or the station tanks, though they do not like such water or the presence in it of *Stegomyia*; and the author suggests that these tanks should be used as traps or as a means of supplying fish nurseries with larvae.

Tuck (G. L.). **Investigations into the Relationship of the Tarbogan (Mongolian marmot) to Plague.**—*Lancet, London,* 23rd Aug. 1913, pp. 529-535, 4 figs.

The author states that although a sick *Arctomys bobac*, Schreb. (the true marmot, called "tarbagan" in Mongolia and "woodchuck" in America) was found, in June 1911, to be infected with plague, the extensive investigations made in the following month by Russian and Chinese expeditions into an alleged epidemic among these animals failed to bring to light a single case or any evidence of such a disease among the marmots. Moreover, it was found that *Ceratophyllus silvantievi* and *Rhipicephalus*, the fleas and ticks living on tarbagan, showed no inclination to bite man. Even starvation did not induce the ticks to do so, and the experiment only succeeded in the case of a starved flea.

Heckenroth (F.) & Blanchard (M.). **Transmission du** *Trypanosoma gambiense* **par des moustiques** (*Mansonia uniformis*). [The transmission of *Trypanosoma gambiense* by *Mansonioides uniformis*.]—*Bull. Soc. Path. Exot., Paris*, 11th June 1913, pp. 442-443.

At 10 a.m., on 8th April, a number of apparently uninfected mosquitos of the species *Mansonioides uniformis* were let loose in a cage containing a healthy guinea-pig and also one infected with *Trypanosoma gambiense*. The former was removed after 48 hours, when the dissection of the insects found alive showed no infection. Nor did an examination of the guinea-pig reveal any trypanosomes on 27th and 28th April and 2nd May; on the other hand, a very few were met with on 30th April, and they were numerous on 5th May. At 10 a.m., on 10th April, the infected guinea-pig was exposed for 24 hours to the bites of mosquitos, which, for the following 23 hours, were left to feed upon another healthy animal. The dissected insects were again uninfected, but on 28th April and 2nd May the animal contained numerous trypanosomes. A detailed table gives the temperatures and hygrometric conditions during the experiments.

Vaillard. **Au sujet des Mesures à prendre contre les Mouches.** [Measures to be taken against Flies.]—*Bull. Mens. Office Internat. d'Hyg. Publique, Paris,* Aug. 1913, pp. 1313-1336.

The author after touching on the indifference to the destruction of flies hitherto prevailing in France, emphasises the fact that these insects can transmit microbes for at least 74 hours after infection; can carry the eggs of parasitic worms, such as *Oxyuris*, *Trichocephalus*, *Taenia echinococcus*, *T. nana*, and others innocuous to man; and propagate the germs of cholera, typhoid fever, infantile diarrhoea, phthisis, granular ophthalmia, leprosy and other diseases in a concentrated form. The remedies suggested are the covering up of foods, cleanliness and subdued light indoors, with netting on the side of the room from which the light is admitted; and, besides the usual glass traps, tanglefoot, and burning or spraying of insect powder, a bait mixture of 15 per cent. formalin, 25 per cent. milk and 60 per cent. water, to which a little sugar may be added. A solution of milk or buttermilk with 10 per cent. formalin may also be thrown on the floors of stables, etc. The greyish blue vapours given off by heated Cresol—which should not itself be brought into contact with flame—in the proportion of 5 grammes per cubic metre, will kill all flies and mosquitos in a room. When the vapours have given it a bluish atmosphere they should be left to penetrate every nook and corner during 3 to 6 hours, when they will destroy all hibernating insects in houses, stables, etc. All rubbish, sewage, putrid matter, etc., should be removed or destroyed; or, when this is impossible, the larvae should be killed by spraying the surface with chloride of lime, slaked lime, petroleum, milk of lime, or sulphate of iron, either powdered or in a 20 per cent.

solution—the last is a deodoriser and is harmless to plants. Sodium arsenate is fatal to larvae, but dangerous to handle. Quicklime, one litre of petroleum per cubic metre, renewed every six months, or a mixture of equal parts of crude schist oil and water, should be thrown into cesspools. The Entomological Station at Rennes has distributed a summary of the above suggestions throughout Brittany, and in Florida the Health Bureau has done the same, laying stress, *inter alia*, upon the cleansing of spittoons and the keeping away of flies from the sick.

Roubaud (E.). **Supplement à la répartition et à la variation géographique des Glossines.** [Further particulars as to the distribution and geographical variations of *Glossina*.]—*Bull. Soc. Path. Exot., Paris*, vi, no. 5, 14th May 1913, pp. 347-350.

The author has made a careful study of the *Glossina* in the collections of the Institute Pasteur and the Paris Museum. He finds that the great majority of the specimens from the French Congo are referable to *G. tabaniformis*, Westw. This species is found at Sangha, Ogove, Lefini and Alima. The true *fusca* appears to be rare on the Congo and the author only found one example from the Upper Sangha. In Western Africa *G. fusca* appeared to be distributed along the lower portion of the Ivory Coast; numerous specimens were found in the collections from Little Bassam, Azaguie, the Lower Sassandra and Bingerville. *G. nigrofusca* and *G. medicorum* have been found at Azaguie, and the latter occurs also in Lower Dahomey, in the Zou district. The author also found on the wooded banks of this same river *G. palpalis* and *G. tachinoides*. Amongst the specimens of *G. morsitans* in the Museum were two *G. austeni*, Newst., taken by Vasse, at Genge, in the Pungwe Valley, Mozambique, in 1906.

The author goes on to say that the study of the material at his disposal showed that a given species varied considerably according to its geographical distribution, especially in the hypopygial characters. He considers that Newstead's name, *submorsitans*, should be used to characterise the western form of *morsitans* in which the structure of the forceps of the hypopygium is clearly peculiar. The distinction between these two geographical sub-species is more or less comparable with, though not so marked as, that which exists between the eastern *G. pallidipes* and the western *G. longipalpis*.

G. palpalis is also differentiated into geographical forms. Those in the damp forest regions of the west (Gabun, Middle Congo, Lower Ivory Coast) are generally of larger size and darker coloration; some forms on the Lower Sangha are almost black, and in all, the superior hooks of the hypopygium are very strongly developed. The western forms found in the neighbourhood of the French Sudan are generally smaller and lighter in colour. The author himself has collected very pale, small specimens at Bani, and says that the same form exists west of the Niger between Bumba and Kirtashi (13°-14° N. lat.). The superior claspers of the hypopygium in this variety are much less developed than in the forest species; they are shorter, the colour invariably lighter and the pubescence much less marked.

The form found on the Lower Casamance, which is refractory to *Trypanosoma cazalboui*, is intermediate between these two extreme types. The author thinks that the species described by Newstead under the name of *fuscipes* may well be considered as the Eastern form of *palpalis*: it is represented in the Paris Museum by a number of specimens collected by Cronier from the Belgian Congo on the volcanos of Kivou, at a height of 5,000 to 5,500 feet.

The author regards this question of the geographical races of *Glossina* as of great importance in relation to the transmission of the different trypanosomes, and considers that these morphological details and the examination of local conditions are worthy of careful study.

SERGENT (Ed. & Et.). **La "Tamné," myiase humaine des montagnes sahariennes touareg, identique à la "Thimni" des Kabyles, due à** *Oestrus ovis*. ["Tamné"—the "Thimni" of the Kabyles—the human myiasis of the Tuareg Mountains in the Sahara, caused by *Oestrus ovis*.]—*Bull. Soc. Path. Exot., Paris*, vi, no. 7, 9th July 1913, pp. 487-488.

It had already been observed by the authors, in 1907, that in certain high parts of Kabylia, where human beings are more numerous than sheep, *Oestrus ovis*, believed to be innocuous to man, ejected its larvae upon the conjunctival and nasal mucous membrane of human beings. It is now reported from the Ahaggar mountains, in Central Sahara, that at a height of from 4,500 feet to 7,800 feet above sea-level the Tuaregs are assailed in the spring by flies which lay their "eggs"—compared by the sufferers to those of lice—on the conjunctiva and the nasal mucous membrane, causing them much trouble from March to June. The Tuareg name for the insect, "Tamné," is the Targui form of the word "Thimni," used for it by the Kabyles.

VASSILIEV (J. B.). **БѢЛЫЙ МАЛЯРІЙНЫ КОМАРЪ И НОВЫЯ ДАННЫЯ О НАХОЖДЕНІИ И ЗИМОВКѢ ЛѢСНОГО МАЛЯРІЙНАГО КОМАРА ТУРКЕСТАНСКОМЪ КРАѢ** [*Cellia pulcherrima*, Theo., with some new facts as to the date of appearance and wintering of *Anopheles bifurcatus*, L., in Turkestan].—ТРУДЫ БЮРО ПО ЭНТОМОЛОГІИ УЧЕНАГО КОМИТЕТА ГЛАВНАГО УПРАВЛЕНІЯ ЗЕМЛЕУСТРОЙСТВА И ЗЕМЛЕДѢЛІЯ [Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture], *St. Petersburg*, x, no. 6, 20 pp. 1913, 11 figs., 1 pl.

Anopheles (*Cellia*) *pulcherrima*, Theo., is the most characteristic representative of the malaria-bearing mosquitos in Turkestan, and in many parts of the country it exceeds in number all other species of Anophelines.

The author gives an amplified description of the insect, and also describes the egg, larva and the pupa, giving figures of these stages.

A. pulcherrimus is found everywhere in the southern part of Russian Turkestan. In 1909 the author found it in large numbers in the Chodjen district of the province of Samarkand, in the so-called "Starvation steppe." In 1910 and 1911 he obtained it frequently from larvae derived from various marshy places in the district of Tashkent, of the province of Syr-Daria, and from the rice-fields near the town of Andijan, in the province of Fergana. A few years ago K. E. Demokidov found it in Bairam-Ali in the district of Merv of the Transcaspian province. Besides Russian Turkestan the insect is known only from India.

As is common with other species of malaria-carrying mosquitos, the females are more numerous than the males. Out of 367 insects found by the author and by G. V. Zenenko, 347 were females and only 20 males, the proportion of the sexes thus being 94½ per cent. to 5½ per cent. The flight of the mosquitos of the first generation begins in Turkestan in the middle of April and probably even earlier; the latest time of hatching out is given as the 15th October; thus the breeding of the insects goes on during a period of six months. The number of generations has not been established, but assuming that the average duration of the development is three weeks (as is the case in August and September, while during the summer it is even shorter) there must be at least eight generations.

Flight generally takes place either in the evening (6-7 o'clock) or early in the morning, sometimes also during the day, at 2-3 p.m. The author gives some figures showing the numbers of the mosquitos in human dwellings. G. V. Zenenko collected, on the 14th August 1911, in two rooms of a house 190 specimens. On the 9th September the author found in the same place over 90 specimens. The author mentions that *A. pulcherrimus* is more attracted by the light of a lamp than other species of malaria-carrying mosquitos in Turkestan; another feature of the insect is that it will attack people in the open air, at some distance from human habitations. It bites not only at night or during the evening, but also during the day. The insect is very cautious and it is difficult to kill one by hand when biting.

The fertility of the females is very considerable, the total number of eggs deposited in the laboratory exceeding 400. These are usually laid in three lots at intervals of 2, 3 and even 6 days. Before each oviposition the female feeds on blood. The author gives a table showing the details of oviposition in his laboratory in 1911. The eggs are deposited in packets, which settle afterwards into a star-shaped mass, the larvae hatching out in two days.

Larvae of *A. pulcherrimus* were found by the author in pools fed by subsoil water or by water from the "arikes," in Tashkent, or in rice fields, near Andijan; but their chief breeding places are the small shallow lakes and the "tugai" which are filled with water-plants. The author describes and figures one such lake, the so-called "Shallow Lake," which is situated in the Chodjen district of the province of Samarkand, near the Syr-Daria station of the Central Asian railway; it lies in the middle of the "Starvation Steppe," not far from the right bank of the river Syr-Daria. The water-plants found there are *Vallisneria*, *Ceratophyllum*, *Potamogeton*, *Myriphyllum*, *Najas*, *Chara* and various others. The numerous small fish found in the lake, as well as various rapacious water insects, such as *Corixa*, *Naucoris*, *Notonecta*, *Ranatra*, etc., or the larvae of *Epitheca*, *Cordulia* and *Agrion* or of *Chloe* and *Ephemera*, do not interfere seriously with the existence in the waters of *A. pulcherrimus*, and the author found larvae in this lake continuously during the six months from April to the middle of October. There are, however, times when they more or less disappear, namely, when the lake is full or when the water is very low. During the former period the depth and area of the lake increases considerably, thus destroying the favourable conditions for the development of the insects. At the second period, at the end of the summer, various weeds (*Aphanotheca gelatinosa*, *Anabaena lemmermanni*, *Arthrospira gommontiana*, *Lyngbya kützingii*, *Rivularia natans* and others) grow in large quantities and make it impossible for the larvae to live. The most favourable time for their breeding in the lake is the time after high water, when not only the usual conditions in it are restored, but also algae make their appearance on which the larvae feed.

The development of the larvae in August and September in the aquarium at a temperature of 19° R. (75° F.) requires about 3 weeks, while in June and July, at a temperature of 26° R. (90° F.), it takes about 2 weeks. The development of the pupae does not take more than 2 to 3 days.

In addition to algae, dissection has revealed in the stomachs of the larvae the presence of various other forms of aquatic life:— *Chlorella*, *Polyedrium*, *Chloresterium*, *Oscillatoria*, and especially *Cymatopleura solea*, *Cocconeis*, *Navicula*, *Epithemia gibba*, *Nitzschia sigmoidea*, *Cymbella* and others; there were also found remains of deep water plants and infusoria. The insect winters in Turkestan in the larval stage, and not as an imago, as is the case in India. The author comes to this conclusion, firstly, from the fact of having found, on the 14th April, 90 full-grown larvae, as well as pupae; and secondly, because in autumn there are mostly found quite young or half-developed larvae. This was definitely proved in 1912, when the author visited Turkestan in the winter and found there in December wintering larvae of *A. pulcherrimus*. Some larvae taken by the author to St. Petersburg in 1911 hibernated in the aquarium in the same stage.

The author reports that some larvae in his aquarium stood quite well a temperature of 7·5° R. (49° F.), followed by freezing of the water in the aquarium, and only died in January 1912 because of the sudden rise in the temperature, after the frost of −11° R. (−7° F.) which took place the day before. During the author's investigations in Turkestan in the winter of 1912 he did not find (on the Starvation Steppe and near the "Shallow Lake") any imagos of *A. pulcherrimus*, although he found there, especially in human dwellings, wintering imagos of *A. claviger* and *A. superpictus*.

A. pulcherrimus is considered to be the chief cause of malaria amongst the population of the southern part of Russian Turkestan. The author reports that in those places of the province of Samarkand where this disease prevails, the above insect is found more commonly than any other species of *Anopheles*; while near the railway station of Syr-Daria *A. pulcherrimus* is practically the only representative. During the first half of August 1911 the author and his assistant collected there 319 specimens of malaria-carrying mosquitos, out of which there were 314 specimens of *A. pulcherrimus* and only 5 of *A. claviger*. No other species was found there. The author refers to two previous papers of his, in which he dealt with the question of fighting the malaria mosquitos and his recommendations apply also to *A. pulcherrimus*. But its mode of wintering and its early flight in the spring suggest that the breeding places ought to be treated with kerosene not later than the end of March, so that the insects cannot hatch out.

Besides *A. pulcherrimus*, the author has previously discovered three other species of malaria-carrying mosquitos in Turkestan:—*Anopheles claviger*, F., *A. pseudopictus*, Grassi, var. *flerowi*, Portch., and *A. superpictus*, Grassi v. *vassilievi*, Portch. In December 1912, he found a fifth species of these mosquitos, *A. bifurcatus*, L. This insect winters in Turkestan in much the same manner as *A. pulcherrimus*, namely, as a larva, which fact is in accordance with the investigations of Galli-Valerio, Narbel and Rochaz in Switzerland. The author found on the 21st and 24th December 1912 over 90 larvae of *A. bifurcatus* near Tashkent in an "arick," neglected and grown over with canes and *Chara*, the water of which was 10-15 cm. deep and had a smell of sulphuretted hydrogen. All the larvae were obtained from the bottom of the water-hole, or rather from the water-plants covering the bottom; the temperature of the water on the 21st December was 5° R. (43° F.) and on the 24th 1° R. (34° F.), with a thin cover of ice. Most of the larvae were half-grown, but there were also young and fully grown ones.

Besides these insects there were also obtained from the bottom of the hole wintering larvae of *Culex* and *Dixa* as well as some rapacious larvae of *Chloe* and *Agrion*. About 30 specimens were taken to St. Petersburg where one half was kept in an aquarium between the frames of the double window of a dwelling room; while the other half was left inside and kept at the room temperature. The larvae between the window frames dropped to the bottom of the aquarium when the temperature was near freezing point and attached themselves, as did those of *A. pulcherrimus*, to the leaves of the plants there. During the $2\frac{1}{2}$ months of their wintering they stood very well a temperature of 3·5° R. (40° F.) and freezing of the water in the aquarium. On the 14th March they were taken into the room, where at the end of that month 11 specimens of *A. bifurcatus* emerged. The larvae which remained since the 30th December inside the room produced mosquitos throughout January.

The Protection of Meat from Flies.—*Australasian Med. Gazette, Sydney*, xxxiii, no. 18, 3rd May 1913.

A letter is published in the Gazette from the largest firm of butchers in Auckland, in which it is stated that screening meat from insects has effected a great saving, as it has diminished trimming for fly-blows; it has increased the sales, the public appreciating the change; the meat has kept better, and less ice has been used than when the meat had to be kept in the ice chest. The screens do not interfere appreciably with ventilation, and the system has been found so advantageous in every way that the firm is extending it to all its branches.

SHOEMAKER (H.). **Pellagra, Surgery, the Colloids, and Strong Drugs.**—*New York Med. Journ.*, 2nd Aug. 1913, pp. 214-219.

The author starts from the premiss that mosquitos and all species of flies, including *Musca domestica*, *Simulium*—very numerous at Shelby, N. C., in the season beginning March 1913—and *Stomoxys calcitrans*, carry parasitic mites; of which *Leptus irritans* and *L. americanus* (Harvest-bugs, Red-bugs or Jiggers) attack human beings, while *Pediculoides ventricosus* of straw disease, which is predaceous on the larvae of *Sitotroga cerealella*, *Isotoma grande* and *I. tritici*, is obnoxious to man. Such being the case, the author suggests that the possible relation of such mites to pellagra must be investigated by those who uphold the theory of its propagation by flies; for the mites may limit the disease by the destruction of the fly larvae, or may, on the other hand, carry the germs within themselves. He adds that the etiological factor of the disease should be sought where there are preliminary symptoms very suggestive of pellagra.

The Bed-bug in a New Rôle.—*New York Med. Journ.*, 26th July 1913, p. 191.

An editorial comment upon the occurrence of five cases of typhoid, in 1910, on an island immune in every respect from the disease. This was found not to proceed from food, water, flies, drainage or sewage, but from a prisoner captured in a distant town where typhoid was endemic, who transmitted it to four other occupants of cells in the guard-house. A careful examination was made and it was ascertained that the air and numerous bed-bugs were the only factors which the inmates had in common. Complete extermination of the pests was effected by fumigation, and the disease wholly and permanently disappeared. Two other cases of typhoid are mentioned, in which every other conceivable source of infection was eliminated; and the insects would appear to account for many others in which the fever, for no ascertainable cause, passed from one person to another within the same building.

Coad (B. R.). **Oviposition habits of *Culex abominator*, Dyar and Knab.**—*The Canadian Entomologist, London, Ont.*, August 1913, pp. 265-266, 1 fig.

Beds of *Ceratophyllum, Potamogeton, Lemna* and similar aquatic plants, which frequently form in the rivers and lakes of the north-central States, are more or less impervious to fish, but provide enough open water to allow the breeding of mosquitos, *Culex abominator,* which is unique in this respect, lays large masses of very black eggs firmly attached to the plant and to each other by their truncate base, near the margin on the upper surface of *Lemna* fronds, whence it is easy for the hatched larvae to wriggle into the water. This was observed at Havana, and the author believes that the fact has not been notified before. No other plants were resorted to except in one case, in which the edge of a *Potamogeton* leaf was used.

Mouzels (P.). **La Fièvre recurrente au Tonkin.** [Recurrent Fever in Tongking.]—*Ann. Hyg. et Med. Coloniales, Paris,* xvi, no. 2, pp. 249-282.

The epidemic of recurrent fever which attacked Hanoi in 1907-8 has been mistakenly attributed, the author believes, to coolies from Yunnan, supposed to have contracted the disease from Pe-chi-li Chinese working with them on a railway station; for the fever was known in Annam at least as early as 1889, when a number of natives preparing for the Exhibition in Paris were found to have brought it with them. Although ticks, lice, bugs, fleas and mosquitos are all capable of carrying live spirilla for a considerable time, ticks are locally so rare as to be wholly out of proportion to the incidence of the disease; again, there were neither bugs nor fleas that could, during five years, be rendered responsible for the intramural infection in the native hospital; and there were neither lice nor bugs to cause the epidemic raging in the house of a well-to-do Annamese. In both cases mosquitos had access to the patients, who, in the hospital, were not free from lice, while those in the private house may have been bitten by the numerous fleas infesting the eight cats kept there. Dogs and monkeys, as well as human beings, can be inoculated with the fever, but the question whether these or other animals keep the disease in existence in the intervals between epidemics, or in what manner it survives them, is still unsolved. The author foresees some trouble in getting the Annamese to cut their lice-infested hair, to rid their huts of fleas and bugs, and to destroy all the breeding places of mosquitos. It may be less difficult to prevent the fever-striken from carrying the disease about from place to place, by isolating them several hundred yards away from their villages, cutting and burning their hair, disinfecting their clothes and preventing mosquitos from having access to them. Sterilisation can also be affected by injecting "606," which, besides its curative effect, almost immediately eliminates the germs and renders the patient non-infectious.

O'FARRELL (W. R.). **Preliminary Note on a New Flagellate, *Crithidia hyalommae*, sp. nov., found in the Tick *Hyalomma aegyptium*, L.**—*Journ. Trop. Med. & Hyg., London*, 15th Aug. 1913, pp. 245-246, 8 figs.

The author describes the flagellate stage of a newly discovered protozoal parasite of the common cattle tick of the Anglo-Egyptian Sudan.

CELLI (A.). **La Malaria in Italia durante il 1911.** [Malaria in Italy in 1911.]—*Ann. d'Igien. Sperim., Turin*, xxiii, pt. 1, 1913, pp. 1-61.

In 1911, a very wet spring, following upon a long and severe winter, kept back the mosquitos until the warm weather, when they appeared in swarms. There was little malaria in Lombardy and the Provinces of Vercelli, Grosseto and Cotrone, and it remained fairly stationary in Latium and the South generally; on the other hand there was a recrudescence in the Lower Venetian region, which was more marked in Sicily, Sardinia and Algeria. In Bulgaria and Greece the epidemic was very mild. There does not seem to have been a uniform relation between the intensity of malaria and the number of mosquitos, but in the lower Veronese region, as in Bulgaria, it was found that the disease was more widespread where the ricefields were badly cultivated. In one case in Algeria malaria was found to extend for about three miles from the marsh in which the mosquitos bred.

The number of species known to carry the disease is constantly increasing, and in the valley of the Amazon *Anopheles (Cellia) albimanus* and *argyrotarsis* have been added to the list.

The cheapness of heavy petroleum oil is counterbalanced by its leaving air-holes for the larvae on the water. Where it has been possible to cover this completely with algae, on the other hand, neither larvae nor nympths have been found, and the same result can be obtained if the water is kept wholly free from marsh vegetation. The imago can be destroyed in winter by spraying the walls of cellars and similar buildings with "Mikrothan" and "Floria." A *Ceratopogon* is said to attack mosquitos, but the question is whether, if introduced, it might not itself propagate the disease.

GOBERT (E.). **Quelques Aspects du Problème antipaludique en Tunisie.** [Some aspects of the Malaria Problem in Tunis.]—*Arch. Inst. Pasteur., Tunis.*, nos. i & ii, 1913, pp. 121-128.

An endemicity of 80 per cent. among the infant population in the neighbourhood, with a high mortality among the adults, of whom the survivors were unable to work, are the conditions which, the author says, preceded the draining of the Mabtuka Garaa lake, which was covered with swarms of mosquitos during the greater part of the year. Since the drainage, examinations made at the beginning of June and end of September disclosed neither enlargement of the spleen in infants nor fever among adults, the only cases of the latter being doubtless attributable to a smaller piece of stagnant water as yet undrained. The drying of marshy ground in the Mateur hollow has also lessened disease there, and herds of swine are frequently driven through the waters of the overflow so as to interfere with the breeding of *Anopheles* in them. Sluggish streams in the Cape Bon and Beja regions, and stagnant water from the inundations of the river passing through the plain of Tabarka, tell the same tale of disease, against which, pending drainage, there appears to be no remedy except the distribution of quinine.

WEISS (A.). **Seconde addition au Catalogue des Arthropodes Piqueurs de l'Ile de Djerba.** [A further addition to the list of biting arthropods of the Island of Jerba.]—*Arch. Instit. Pasteur, Tunis*, nos. i & ii, 1913, p. 118.

The author states that *Culex geniculatus*, Oliv. (= *hortensis*, Fic.), known in France and Italy, appeared in great numbers at Jerba—the first time it has been observed in Northern Africa—during the whole winter of 1912-1913, its reproduction taking place in polluted waters. A solitary specimen of *Tabanus cordiger*, Meigen, probably carried on a beast imported from the Continent, was found in October 1912. *Lynchia maura*, Bigot, a parasite of the domestic pigeon, has also been observed.

MITZMAIN (M. Bruin). **The Biology of *Tabanus striatus*, Fabr., the Horsefly of the Philippines.**—*Philippine Jl. of Science, Manila*, viii, Ser. B, no. 3, June 1913, pp. 197-218, 7 pls.

The author says that *T. striatus* is the most prevalent horsefly of the Philippines, and is possibly concerned in the transmission of trypanosomes, because it is abundant wherever surra is found, and the seasonal distribution of the fly and the disease are more or less coincident throughout the Archipelago. In Manila, and within a radius of 50 kilometres, *T. striatus* is found more or less continuously from October to March, but this also applies to other blood-sucking flies. In the Philippines, *Tabanus* has never been proved to be a carrier of trypanosomes, but it is at present the subject of experimental investigation. For this purpose it was essential first to breed the fly in large numbers and this paper contains the results of the rearing of thousands of flies under laboratory conditions in the Veterinary Research Laboratory, Alabang, Rizal. Up to the time of writing this paper, the author had not succeeded in locating eggs or larvae in their natural habitat, in spite of great efforts extending over three months, though while it was passing through the press both larvae and pupæ were discovered in large numbers buried in sand at many points on the shore of Laguna de Bay. The area in the neighbourhood of the laboratory proved an ideal place for the study of the fly. A herd of 50 cattle was pastured on it, and until about 2 o'clock in the day the animals were disturbed by the attacks of the flies, which during the hotter portions of the day and through the night rested on the trunks of an avenue of rain trees (*Enterolobium saman*, Prain.)

In order to obtain eggs for study, a specially constructed building, covered with brass gauze and having a cement floor was erected, being sufficiently large to contain four to six carabaos. In one portion of this a concrete water-tank filled with growing plants was provided. Two carabaos were placed in this with thousands of flies which were gathered while resting on the rain trees. In a short time females were observed feeding on the hosts provided and several were found ovipositing in various places about the enclosure. The author observed that the eggs were invariably laid during the early afternoon and never later than 2 o'clock (50 cases). They were laid in compact masses, usually surrounding such objects as projecting splinters of wood, fibres of jute sacking, fine brass wire, etc. When deposited on a flat surface, leaves were selected on two occasions. In all other cases the eggs were deposited on woodwork, etc., and invariably on the shady portions. The method of oviposition is described at length, and the flies were observed to lay with clock-like precision at the rate of 10 eggs per minute; in three cases the whole process occupied 40 to 45 minutes. The eggs of this species of *Tabanus* are laid with very little cementing material, which is waterproof and was found to be insoluble in various strengths of alcohol and xylene. The numbers laid in a mass vary greatly. In four masses counted, there were respectively 270, 340, 417 and 425. Hatching takes place in between three and five days, the period being influenced by temperature and moisture.

Immediately after emergence the young larvae hide themselves. They were fed on various kinds of food and throve on minute crustacea, larvae of *Stomoxys* and of mosquitos, and on young angleworms. Blowfly larvae were not satisfactory, unless previously killed, as they were capable of killing or injuring even well-grown *Tabanus* larvae. Feeding is not a continuous operation and there is a long rest after a sufficient meal. At two days old a *Tabanus* larva is capable of devouring 2½ well-grown *Stomoxys* larvae in 25 minutes. The method of feeding is carefully described, and the author says that the *Tabanus* larva when full-grown does not wait for its food, as in the young stage, but actively pursues its prey. Cannibalism occurs, especially in the presence of food which all cannot reach at the same time, and in one experiment 85 per cent. of a large number of larvae were destroyed in this way.

The larvae can remain submerged in water for several minutes at a time without apparent discomfort. They are capable of swimming, but if placed in deep water the movements of the body are apparently purposeless. The young larva is well adapted to an aquatic life and was observed to have no difficulty in keeping afloat in water containing mosquito larvae and feeding upon them, being quite capable of killing one fully five times its size. The more developed larvae do not appear to be able to adapt themselves to life in water so well as the young ones. The process of moulting is described at considerable length and also the full-grown larva and pupa.

Thirty flies tested refused to feed on the first day of emergence, three fed upon the second day and the remainder took their first meal on the third and fourth days. Flies under observation were found usually to bite not more than once in two days. The cases which occurred of biting on consecutive days were considered to be abnormal. The attitude of the fly and the manner of inserting the proboscis is carefully described. The bites appear to be very painful to the host and the insect is never satisfied with a single bite, but makes several punctures before a complete meal is obtained. This may possibly be due to the interruptions caused by the tormented animal, and the fly may have acquired the habit of making short swift stabs in order to facilitate its escape from the host. *T. striatus* bites cattle and carabaos and the author says that during more than two years of personal observation he has never known it to annoy man in the Philippine Islands. Reported attacks can usually be attributed to *Stomoxys*, which frequently annoys the natives in charge of draught animals. The author has seen sparsely-haired carabaos with their bodies covered with droplets of dried blood resulting from the bites of Tabanids and he has been able to collect 61 specimens of *T. striatus* from a single carabao in less than 15 minutes.

The fly usually begins to bite between 7 and 8 o'clock in the morning and is again active between 3.30 and 6 o'clock in the afternoon. The rain trees before mentioned have been observed to harbour *T. striatus* of both sexes at all hours of the day and far into the night. If the weather be windy they congregate together on the side of the trunk protected from the wind. When very numerous they come into the houses and are usually to be found on the windows. The seasonal prevalence of the fly in 1912 was as follows:—Appreciable numbers were first seen on August 15th. From that date to 4th September males predominated in the proportion of two or three to one female, but shortly afterwards the female count increased to the proportion of one male to 1·7 females. Females preponderated to the extent of three to one in October and four or five to one in December. The first appearance of mammalian blood in collected flies was found on 4th September, although cattle had been present for eight days previously, and from 4th to 6th September the majority of the females collected contained blood. The first date of oviposition was on 11th September.

Mitzmain (M. B.). **The Mechanical Transmission of Surra by** *Tabanus striatus*, **Fabricus.** — *Philippine Jl. of Science, Manila*, viii, Ser. B, no. 3, June 1913, pp. 223-229.

The author says that recent work has practically eliminated *Stomoxys calcitrans* from further consideration as an important factor in surra dissemination in the Philippine Islands and in this paper he records the results of experiments on the direct transmission of the disease by *T. striatus*. The flies were first allowed to bite an infected horse or guineapig for about 45 seconds and were then transferred to a healthy animal and allowed to complete the meal. The healthy animals used were most carefully proved to be free from trypanosomes. Three positive experiments resulted and are described in detail. One was a monkey, the second a horse and the third a horse. Attempts to induce the flies to feed on healthy and on infected animals kept together in a large screened cage failed, the flies dying in a few days when kept within the enclosure. Female Tabanids to the number of 2,087 were liberated in this cage between 9th November and 22nd December and 14 months afterwards the exposed carabao remained normal. Two guineapigs inoculated with its blood were alive and negative on 12th April, 1913. Experiments were made to determine the possibility or otherwise of the hereditary transmission of trypanosomes in these flies. The results were negative. Further attempts were made to transmit surra by other means than biting. A highly infected guineapig was used to contaminate the flies, and a portion of the skin of healthy and infected animals was abraded with a razor and the flies applied individually in tubes. The flies were permitted to lap the blood from the abrasion on the infected animal for a minute or less, and then transferred to the healthy animal where it was induced to apply its labellum for from five to ten minutes. The results of all the trials were negative, although it was ascertained that typical trypanosomes were present upon the labellum of one of the flies and in the stomach of another fly immediately after the experiment.

Experiments as to the length of time *T. striatus* can harbour infective trypanosomes, showed that though organisms indistinguishable from those of surra could be found in the flies 30 hours after biting an infected animal, after 10 hours the flies ceased to be infective.

Townsend (C. H. T.). **The Vector of Verruga, *Phlebotomus verrucarum*, sp. nov.** — *Insecutor Inscitiae Menstruus, Washington D.C.*, i, no. 9, Sept. 1913, pp. 107-109, 1 plate.

The author gives a full description of this new Peruvian *Phlebotomus*, and in a supplementary note adds that since writing the paper, the successful transmission of verruga by this species has been accomplished in a dog, which was infected on 11th July, the eruption appearing on 17th July. (*See* this *Review*, Ser. *B.* I., p. 163.)

Thompson (D.). **Preliminary Note on Bed-bugs and Leprosy.**— *Brit. Med. Journ*, 4th October 1913, p. 849.

The author refers to articles by Sander and Long (B.M.J. ii, 1911, pp. 469-470), in which it was stated that a large percentage of bed-bugs experimentally fed on lepers, or caught within their dwellings, contained acid-fast leprosy bacilli; whilst those caught in the dwellings of healthy people contained none; the presumption being that the bed-bugs caught played an important part in the transmission of the disease. The author attempted to confirm these observations in 1911, but failed to do so. In 1912 he repeated his observations in the leper asylum at Palo-seco in Panama with ample material. He fed 84 bed-bugs on various cases and in none of these, nor in 17 bugs caught on the patients' beds, was he able to detect acid-fast bacilli; nor was he more successful with 18 others caught on the beds of lepers in the asylum at Trinidad; 86 bugs caught in the Spanish wards in Ancon Hospital in Panama, and 21 others caught in dwellings in Liverpool and used as controls gave negative results. The Ziehl-Neelsen stain was used throughout.

HADWEN (S.). **On "Sick paralysis" in Sheep and Man following Bites of** *Dermacentor venustus*.—*Parasitology, Cambridge*, vi, no. 3, Oct. 1913, pp. 283-297, 2 pls.

"Sick paralysis" occurs in British Columbia and affects man, sheep and probably other animals. The disease is caused by the bites of *Dermacentor venustus*. It is usually of short duration, is benign in character, but occasionally it persists for long periods, and may terminate fatally. From an economic point of view, the disease is of some importance to the sheep industry. The causative agent has not been discovered, and the disease has not been reproduced by inoculation. The most likely hypothesis is that the tick injects a toxin which gives rise to symptoms appearing coincidently with the complete engorgement of the tick. In three consecutive cases, induced by the experimenter in lambs, paralysis occurred six to seven days after the ticks were put on. In no case did the author fail to produce paralysis through the agency of the tick-bites. It has been proved that *D. venustus* usually bites sheep along the back-bone. No larvae or nymphs were encountered on sheep, and there is no record of their attacking man in British Columbia.

HADWEN (S.) & NUTTALL (G. H. F.). **Experimental "Sick paralysis" in the Dog.**—*Parasitology, Cambridge*, vi, no. 3, Oct. 1913, pp. 298-301.

The condition of "Sick paralysis" experimentally produced in a dog through the application of a single *Dermacentor venustus*, female, was the same as that observed in sheep, as described in the preceding paper. The examination of the dog's blood proved negative. The negative results of inoculations and the absence of fever indicate that the disease is not infective, although the incubation period suggests the contrary. It is only when the tick begins to engorge or feed rapidly, some days after it has become attached, that its saliva produces pathogenic effects. Where the ticks are picked off or rubbed off early, no pathogenic effects follow. So far as records go, it is only the adult ticks which attack man, or larger animals in Canada.

Nuttall (G. H. F.) & Hindle (E.). **Conditions influencing the Transmission of East Coast Fever.**—*Parasitology, Cambridge,* vi, no. 3, Oct. 1913, pp. 321-322.

The life-cycle of *Theileria parva,* the parasite of East Coast Fever has not yet been elucidated. Nor has Gonder's account of the life-cycle of the parasite within the invertebrate host, *Rhipicephalus appendiculatus,* been confirmed.

A summary of the experiments carried out by the authors on the transmission of East Coast fever permit of the following conclusions, seven in number:—(1) Infected ticks do not produce infection during the first two days when feeding on cattle; (2) infected ticks are still infective after feeding upon a rabbit for three days; (3) heating infected ticks to 37° C. for three days does not render them infective during the first two days after they become attached to the host; (4) the partial feeding of infected ticks for two days, followed by starvation for 17 days, renders them non-infective; (5) inoculations of emulsions of infected

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ERRATA.

Page 204, lines 12, 15, 32 and 35, for "Sick Paralysis" read "Tick Paralysis."

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action: for instance, the parasite which occurs in the dog is only capable of setting up the disease in the dog.

Usually about 8-10 days after the animals have been attacked by the ticks they show high fever, loss of appetite, etc., and a large number die in a few days—anything from 25-100 per cent. succumbing to the infection. In severe cases, the number of corpuscles in the circulating blood may be reduced to a third or less. When animals recover they do so slowly, and the parasites grow very scarce in the blood.

The piroplasmosis of cattle is due to at least two species of *Piroplasma, P. bovis* and *P. divergens.* The latter parasite is transmitted by *Ixodes ricinus,* the common European cattle tick. The well-known Texas fever of the United States, generally known as "redwater," is due to *P. bovis,* and appears to be transmitted in nature almost solely by *Boophilus annulatus* and its varieties.

"Redwater" in horses is due to two distinct parasites. When a horse recovers from infection by the one, it is still susceptible to infection by the other. *Dermacentor reticulatus* has been shown by experiment to transmit the disease. Ovine piroplasmosis is conveyed by *Rhipicephalus bursa*, and the canine disease is transmitted by *Rh. sanguineus* in the northern hemisphere, though in South Africa *Haemaphysalis leachi* is the vector.

The only drug which exerts an influence on some of these parasites is trypan-blue, a dye which is administered intravenously, in preference to subcutaneously, in 1-1½ per cent. aqueous solution. A dose of 5-10 cc. is curative for dogs, and the drug is being used to-day in many parts of Africa where it was previously impossible to keep dogs. Trypan-blue has no effect upon the parasites of East Coast fever.

Birt (Lt.-Col. C.). **Phlebotomus Fever and Dengue.**—*Trans. of the Soc. Trop. Med. Hyg.*, vi, no. 7.

This paper is a summary of known facts of the relationship of dengue and allied fevers to *Phlebotomus*.

In the year 1908 Doerr announced the results of his experiments on the infectivity of the blood in Dalmatian summer fever, and on the mode of the transmission of the virus by *Phlebotomus*. Since then the closely related ailments in Malta have been investigated in a similar manner. Tedeschi and Napolitani have made a similar inquiry into the nature of the Italian "summer influenza," and Kilroy has put to the test of experiment the causation of the fever as it occurs in Crete.

On combining the successful experimental results, it is found that:—(1) The subcutaneous injection of blood or serum withdrawn during the first twenty-four hours of the patient's illness causes the disease; (2) inoculation with filtrate, obtained by passing the diluted blood through a porcelain candle which retains *Micrococcus melitensis*, also excites the disease; and (3) feeding experiments with infected sand-flies have been successful on twenty-one occasions.

This evidence is sufficient to show that the fever is specific; that it is caused by a filter-passing virus, which circulates in the blood during the first day of the illness; and that it is conveyed by the *Phlebotomus*.

Grassi has studied the life-history of *Phlebotomus* in Italy, and Marett in Malta. It breeds in caves, crannies of walls, and among heaps of stones. The eggs hatch in six to nine days after being laid; the larval stage lasts about eight weeks, and the pupal a fortnight. These flies survive in captivity about ten days only, hence great difficulties are encountered in tracing their history. The genus is widely scattered throughout the tropical and sub-tropical world, and sand-fly fever is almost as broadly distributed.

Dengue breaks out in epidemics which are far more explosive in character than are those of sand-fly fever. The infection runs swiftly through a community, until almost all susceptible people have been attacked. In a few weeks its energy is expended. The rashes which occur in about 70 per cent. of the cases, and the greater severity of the pains, differentiate it from sand-fly fever.

Both infections may occur in the same locality. At Aden, in 1893, the summer outbreak of *Phlebotomus* fever was followed by one of dengue in the autumn. No immunity was afforded by the former infection against the latter; whole families were seized; papular or urticarial rashes broke out in most cases. The author himself was attacked at this time, and in his case joint pains were severe—much more so than in *Phlebotomus* fever—and the initial rash was accompanied by itching of the palms and soles.

Aberrant cases of dengue, and they occur in every epidemic, closely resemble sand-fly fever. Moreover the late eosinophilia observed by Balfour in Khartoum, by Harnett in Calcutta, and by others, also occurs in sand-fly fever, so that the infections cannot be separated by microscopical examination of the blood.

Graham, of Beyrout, was the first to investigate dengue experimentally. After feeding *Culex fatigans* on dengue patients, he caused them to bite susceptible people residing in places where the disease was absent. He thus transmitted the infection to six persons. He also induced the disease by inoculating a man with an emulsion of the salivary glands of an infected *Culex*. In 1906 Ashburn and Craig ascertained that the blood of dengue patients was infective, and that the virus passed through a filter which was impervious to the *Micrococcus melitensis*. Infection has also been conveyed once by infected *Stegomyia*.

There are considerable differences in the infectivity of the virus in sand-fly fever and in dengue. Blood extracted after the first twenty-four hours in the course of sand-fly fever no longer can excite the disease. It has failed to do so in every attempt (five experiments made). The blood of dengue patients with which the successful inoculations were performed was drawn off on the second to the fifth days of the disease.

Whereas *Phlebotomus* are not capable of transmitting sand-fly fever until six days after feeding on a patient who is in the first day of his illness, dengue has been conveyed by mosquitos immediately after their meal of dengue blood; nevertheless the virus survives in them, for they have conveyed the disease eight to twenty-seven days after feeding on a dengue sufferer.

Graham protected families from dengue by means of mosquito curtains. E. H. Ross extinguished epidemics of dengue which had been of yearly occurrence in Port Said by exterminating mosquitos. Evidence is accumulating that *Stegomyia* is an agent in the propagation of dengue. Legendre concludes from a study of an extensive epidemic of this disease at Hanoi in 1910 that this mosquito was the responsible vector, since the outbreak was coincident with a great increase in their numbers, while other species were few.

There is a close resemblance between dengue, sand-fly, and yellow fever infections; they are all caused by some virus which circulates in the blood, and is capable of passing through a filter which retains bacteria; the onset of the fever is similar in many instances, and during the first forty-eight hours of the illness it may be impossible to distinguish between the infections; even later a diagnosis on clinical grounds may be unattainable, for atypical cases of dengue and yellow fever may bear every likeness to *Phlebotomus* fever. Hence, too great stress should not be laid on the symptoms of individual patients during the course of an epidemic; it is the general type of case which will give the name to the outbreak.

Donovan (C.). **Kala-azar, its Distribution and the probable Modes of Infection.**—*Proceed. 3rd Meeting Gen. Malaria Committee, Madras,* 18*th*-20*th Nov.* 1912, *Simla,* 1913, pp. 211-214.

After enumerating a number of places in which kala-azar is endemic, all low-lying, damp and near rivers, and very suitable for malaria, the author goes on to discuss the probable modes of infection, viz., either by foods contaminated by excreta or other substances, or by means of insects. He is of opinion that though Patton has done much to prove transmission of *Leishmania donovani*, the kala-azar flagellate, by bed-bugs, the fact cannot be accepted in its entirety until several points are elucidated. *Conorrhinus rubrofasciatus*, supposed, like *Reduvius personatus*, to feed on bed-bugs, may be another instrument: for it sucks human blood under natural conditions, and another *Conorrhinus* transmits human trypanosomiasis in Brazil. The flagellates harboured by Culicids are not *Leishmania*: and in a case at Nungumbakum a girl of 13, suffering from kala-azar, had no malarial parasites in her blood, whereas her father and two younger sisters had malaria at the same time, and there were no other cases of either disease in the locality. The *Herpetomonas* of *Musca nebulo* differs in several ways from *Leishmania*, so that the house-fly cannot be accused of transmitting the disease. Head and body lice, like *Ornithodorus savignii*, have given negative results, and although the dog flea has been accused of transmitting infantile kala-azar in Europe, in India the dogs examined have afforded no evidence of harbouring *Leishmania*.

Ranck (E. M.). **Horn Flies and other Insects.**—*Miss. Agric. Expt. Station Circular,* July 1913, 13 pp.

Cattle on ranges in Mississippi are frequently attacked by myriads of flies, mosquitos and other insects, which not only weaken them by sucking quantities of blood, but the annoyance from the stings and bites almost drives the animals crazy. It is recommended that all wood pastures, especially swamps, should be provided with a large open space, so that the cattle can come out from the woods in certain parts of the day when the flies are most numerous, and stand in this opening. It has been observed that insects are not nearly so numerous in such open spaces as in dense thickets, especially in swampy places. The use of sprays is recommended, especially for milch cows and animals that can be brought into a field. The following mixture is given as effective. Crude cotton seed oil, 2 quarts; kerosene, 1 quart; crude carbolic acid, 1 pint; oil of tar, 10 ozs.; oil of pennyroyal, 1 oz. Smudges are also recommended to be used when the wind is in such a direction as to carry the smoke across the clearings.

Tick fever is dealt with on pages 16 and 17 for the general information of farmers, and methods of treatment are given.

Patton (W. S.) & Cragg (F. W.). **On certain haematophagous species of the genus *Musca*, with descriptions of two new species.** —*Indian Journal of Medical Research, Calcutta*, i, no. 1, July 1913, pp. 11-23., 5 pls.

The special interest and importance of the group of flies dealt with in this paper lies in the remarkable manner in which they obtain their food; being unable to penetrate the skin of the host themselves, they rely on other and better equipped flies to do it for them and feed on the blood and serum which exudes from their bites. To this end they associate themselves with the biting Muscids.

Observations of these flies show that on approaching a biting fly in the act of feeding the *Musca* will endeavour to thrust its proboscis into the wound, and to oust the rightful occupant. The authors say that they have frequently seen as many as 6 individuals of *Musca pattoni*, a large fly, assembled round a single small *Philaematomyia insignis*, waiting for it to withdraw its proboscis. The larger Tabanids, which make a deep and complete wound, provide a frequent supply of blood. These flies are not entirely dependent on those capable of drawing blood for their food, for they readily suck up the moisture which exudes from open sores, and the authors point out that the manner in which they obtain their food raises an interesting question as to whether they do not represent a stage in the evolution of the blood-sucking and biting forms. Their capacity for the transmission of infection is to a large extent accidental, but at the same time the possibility of their travelling directly from an infected wound to an uninfected one and carrying poison with them must not be overlooked. It is only when they happen to be disturbed while feeding that they will fly off to another animal, and in the majority of cases, if accidental infection is to occur in a state of nature, the infective organism must be capable of living for at least 24 hours exposed to the external air. The authors then proceed to describe and figure the eggs, larvae, pupae and perfect insects of 4 species which they have studied in South India, stating that they all resemble the common house-fly superficially, and that identification is not always easy. The species are as follows:—*Musca gibsoni*, sp. n., found at Kodaikanal in the Palni Hills, South India, at a height of 6,000 feet. The authors say that they have never seen it in the plains, but it was extremely common in the month of September and that on one occasion over 200 specimens were taken on one horse in 2 hours. It appeared to cause more annoyance to cattle and horses than did the true biting flies and to be chiefly dependent upon *Stomoxys calcitrans* and *Bdellolarynx sanguinolentis*, which it worries in a remarkably persistent manner, as many as a dozen at a time being seen round one individual endeavouring to force it to withdraw its proboscis. Both male and female suck blood. The eggs are laid separately (about 50 at a time) in cow-dung, as it lies in the field and not in places in which it has been collected. *Musca pattoni*, Aust. (1910), is abundant in Madras throughout the year and breeds regularly in the heap of cow-dung kept on the Sewage Farm of the King Institute, Guindy, Madras. It never lays its eggs in isolated patches of cow-dung. Each egg is laid singly. The larvae, unlike those of *gibsoni*, never migrate from the dung, but pupate in it. The flies are only seen on cattle and horses, and they worry *Philaematomyia insignis* and *Stomoxys calcitrans* in much the same way as *Musca gibsoni*.

Musca convexifrons, Thomson (1868), is common in Madras throughout the year, but has not been found in any of the hill stations. The oviposition is similar to that of *Musca gibsoni* and both sexes feed on cattle.

Musca bezzii, sp. n. The male of this handsome fly was first found at Kodaikanal in 1910 by Mrs. Patton. Two years later Cragg found it in Kolagni, in the Nilgiri Hills, and was able to follow its life-history. It is numerous only during the middle of the year and was rarely seen at Kodaikanal in September, and the authors have never seen it in the plains. The fly closely resembles *Philaematomyia gurnei*. It is larviparous and its reproductive habits are similar to those of *M. corvina*, F. (*ovipara*, Portch.), of Europe. Only one young larva is produced at a birth and this passes through the next two phases exactly like the larvae of *gibsoni* or *pattoni*. On two occasions a large egg was laid instead of the larva, one of these kept in moist dung did not hatch and the fact is regarded as abnormal.

Patton (W. S.) & Cragg (F. W.). **A new species of *Philaematomyia*, with some remarks on the Genus.**—*Indian Journal of Medical Research, Calcutta*, i, no. 1, July 1913, pp. 26-33, 3 pls.

The first known species of this genus, *insignis*, was described by Austen in 1909 from several localities in India. Since that time it has been recorded from Ceylon, Borneo, Sokotra, Senegal and the Congo Free State. It appears to be a common fly in the tropics and in Madras, at any rate, it is the commonest biting fly found on cattle. In 1910 Brunetti described a second species, *lineata*, erecting for it, however, a new genus *Pristirhynchomyia*. The authors regard this fly as properly belonging to Austen's genus and describe the male of *lineata* which was not known to Brunetti. This species is not uncommon at Saidapet in cold weather, but is never so numerous as *insignis*. In the hot weather it has been found at Kodaikanal. The authors, after careful observation, are able to say with certainty that it is not able to make a wound for itself, though it is a true blood-sucker.

Philaematomyia gurnei, Patton and Cragg, is described at length. It appears to be a hill species and is somewhat rare. It was proved by dissection to be oviparous. A specimen taken from a cow in the grounds of the King Institute, Saidapet, is regarded as having been imported from the hills with the animal. The remainder of the paper is devoted to a discussion of the general characters of the genus *Philaematomyia*.

Howlett (F. M.). The Natural Host of *Phlebotomus minutus*.—*Indian Journal of Medical Research, Calcutta*, i, no. 1, July 1913, pp. 34-38, 1 map, 1 pl.

The author says that a study of the habits of *Phlebotomus minutus*, the commonest sand-fly in Behar, gives the impression that it is not strictly a domestic species and that it must either be able to dispense with blood altogether or must have some other source of supply than man. It breeds nearly all the year round (at Pusa), but bites human beings only in the summer, and apparently a meal of blood is necessary to secure the fertility of the eggs. The author states that he is now fully convinced that at Pusa a common gecko will prove to be the natural host of *Phlebotomus minutus*, and that the association with man may be of a secondary nature. The evidence with regard to the connection between the sand-fly and lizards is briefly as follows:—The distribution of *P. minutus* is not yet fully known but the typical *minutus* and its variety *africanus* are recorded from India, the Mediterranean area, the Gold Coast, North and South Nigeria, the Sudan, North-East Rhodesia and Nyasaland (Newstead). A map is given showing the distribution of GECKONIDAE throughout the world and the author points out that this more or less coincides with the distribution of *P. minutus*. The natural habitat of the fly at Pusa is practically confined to places where there are stones, bricks or tiles and tree-trunks. The attempt to collect them elsewhere is profitless and this habitat more or less precisely coincides with that of the common Gecko. There is a noteworthy exception to this general statement in that *P. minutus* has been found in some numbers in the nests of termites by T. Bainbrigge Fletcher in the neighbourhood of Coimbatore and by the author at Amritsar. Careful search has hitherto failed to reveal larvae in the cracks inhabited by lizards in the walls of bungalows, but the fact that the female sand-fly will not oviposit in a dry place is sufficient explanation, as all these cracks are dry and sheltered.

It is the adult female *Phlebotomus* which is most closely associated with the gecko. In the evening both come to light, the gecko in search of insects. In the daytime the female flies are often to be seen close to crevices in which geckos are hiding and sometimes enter them, the males generally remaining outside. In a bungalow in which *P. minutus* is abundant, careful examination of the lizards on the wall, at almost any time of day or evening, may reveal that perhaps every other lizard has a sand-fly perched on its back and sucking its blood, an operation which takes a long time, often an hour or more. The lizard rarely makes any effort to free itself of the fly, and has never been seen to eat one, although geckos are well known as voracious insectivores. The fly will only bite man in the hot months in the late evening or very early morning, and it is extremely difficult to persuade them to bite the hand or arm in the laboratory during the day; but if geckos be shut up with sand-flies they are freely bitten at any hour and one lizard may have several flies biting it at once. The author regards this as affording an explanation of an otherwise unexplained fact, that although sand-flies trouble man during the hot weather and rains, yet females of *P. minutus* gorged with apparently fresh blood can be found without much difficulty from November to May, a period during which the human subject is never attacked. The result of the examination of blood in the bodies of 40 specimens of *P. minutus* between 25th April and 5th May show that 11 contained human blood, 24 lizards' blood and 5 doubtful. It was assumed that nucleated corpuscles were those of a lizard. The author says that flies have been seen by himself on one occasion biting another species of lizard and on two other occasions on the head of a common toad. It appears to be possible that these other reptiles afford food for the flies as well as the gecko.

X

MITZMAIN (M. B.). **The Surra-Conveying Fly of the Philippines and some factors concerned in Control Measures.**—*Philippine Agric. Review, Manila*, vi, no. 8, Aug. 1913, pp. 371-379.

The author points out that Bagshawe has indicated that it is possible that an epizootic of surra may be started from an animal in whose blood trypanosomes are scarce. If it were known that one species of insect only is capable of becoming infected from such a host and that flies of this species transmit infection to other animals for a period of many weeks, such knowledge could not fail to lead to economy in preventive methods.

The author's studies of surra in the Philippines lead him now to the opinion that *Stomoxys calcitrans*, L., has little or nothing to do with the transmission of the disease, but that *Tabanus striatus*, F., the common horse-fly of the islands, is the carrier. The breeding places of this fly have now been located on the shore of Laguna de Bay.

The food of the larvae consists not only of the minute crustacea of the lake, but principally of the larvae of the Muscid flies laid in the carabao manure on the swampy land which is cultivated by the lake-shore. In several cases Tabanid larvae have been seen buried in the dung in search of food. The habits of the larvae are described elsewhere (see this *Review*, Ser. B. I, p. 200).

Apparently spontaneous cases of surra, observed late in 1911 and early in 1912, gave rise to the suspicion that *Tabanus* had something to do with the transmission of the disease, but *Stomoxys*, *Lyperosia*, *Hippobosca*, mosquitos and midges were present in such numbers that they could not be regarded as negligible factors. *Stomoxys*, *Lyperosia* and *Hippobosca* have now been investigated from the standpoint of mechanical transmission and may be eliminated. The mosquitos, which have been studied more or less thoroughly in Africa and India in relation to the disease, may also be eliminated, the writer having been able to confirm the negative results obtained by others. Midges (CHIRONOMIDAE) are often present among the draught animals of the Philippines in enormous numbers and in the author's opinion may still be under suspicion, although workers in Africa and India regard them as of no serious consequence in disease transmission.

The question is thus narrowed down to the *Tabanus*. One species of *Tabanus* in Northern Africa is now known to be a carrier of a form of trypanosomiasis closely resembling surra and the fly has also been experimentally proved to carry surra in India and in the Federated Malay States. The author says that so far as Tabanids are concerned the carabao is the most favourite animal, and that there is never any difficulty at the proper season in catching a large number on one of them. He is also of opinion that the body temperature of the animal is of some economic importance, although the matter is at present in a theoretical stage. Howlett in India has endeavoured to demonstrate that mosquitos are positively attracted by a temperature above normal. This theory may be extended to the blood-sucking flies generally. It has been specially noticed and confirmed by many investigators that sick animals are more susceptible to the attacks of *Stomoxys* than healthy ones, and this is especially the case with horses. [This may be due merely to the fact that a sick animal may be too listless to drive off the flies.—Ed.]

Insecticides have been tried for the destruction of horse-flies, but have proved more or less unsatisfactory. Substances acting as repellents have given more favourable results, but direct methods of destruction have proved unavailing. Hine has used petroleum against *Tabanus* in the same way as against mosquitos, and this method is supposed to be effective against the adult flies which visit the water in order to drink. The same investigator provides a most effective measure by gathering and destroying the eggs, and says that in one hour 433 egg-masses were collected, estimated to contain a total of over 108,000 eggs. In the Philippines the only remedial measure used is the destruction of the adult flies, which are collected with a net or trapped with tanglefoot applied to the trunk and larger branches of the rain trees, which form their favourite resting places.

Sick animals should be isolated and they, as well as healthy ones, should be protected from flies; screening, though not always practicable, is a very valuable measure, but considerable protection can be obtained by the use of darkened sheds, or sheds exposed to strong winds, and by building sheds and corrals some distance from bodies of water. Animals at work or at pasture may be covered with a protective wash. All sores and skin abrasions of any kind should be kept covered with tar or some other antiseptic greasy substance disagreeable to flies, both of the blood-sucking and non-biting species. The author recommends that the roofs of animal sheds should be as low as the height of the animals will permit, and in a stable of this kind in India, to which he refers, during one entire surra season only two or three Tabanids were found on animals. The removal of manure from the neighbourhood of stables is of great value, although *Tabanus striatus* does not normally breed in manure, and when larvae of this fly are placed experimentally in great numbers in manure of various kinds, they do not mature. Lime has been used with effect to destroy larvae inhabiting the dung, and any means which will provide for its rapid dessication is sure to be of value. Repellents and washes applied to the animal in the dry season must be renewed every two or three days. It is not necessary to attempt to protect the entire animal but only those parts inaccessible to its head and tail. The United States Bureau of Entomology have extensively tried fish oil alone; fish oil mixed with sulphur and carbolic acid; kerosene emulsion alone or with tobacco water added, and in addition resin and oil of tar. In certain parts of Texas the use of cattle dipping-vats, with suitable insecticides, has been recommended, with very great success. The author says that two distinguished German chemists have suggested that potassium tellurate taken internally repels mosquitos, flies and ticks. This was administered in the drinking water of 9 horses and 1 cow; 10 grams were used for each animal in doses of 1·5 grams, but only negative results were obtained. Experiments with oleum lauri as an insectifuge are said to have given positive results.

HAMER (W. H.). **Seasonal Prevalence of Fleas.**—*Ann. Rept. of the L.C.C. for* 1912, *London,* 1913, p. 64, 1 chart.

From the beginning of 1909 an attempt has been made to obtain a detailed record of the seasonal prevalence of fleas in London and the results are given for the years 1909, 1910, and 1911 in a chart published in the Annual Report of the Council, Public Health, vol. iii, 1911, page 62.

The enquiry until 1911 had been limited to the observation of flea prevalence in common lodging-houses, but towards the end of 1911 additional information was obtained on the examination of elementary school children by counting the numbers flea-marked. The Medical Officer of Health remarks that the number of flea-marked children found in the last four months of 1912 agrees very closely with the curve obtained from common lodging-houses. The maximum appears to be reached in August and September and the minimum in January.

Insect Notes from the Seychelles.—*Ann. Rept. on Agric. and Crown Lands for the year* 1912, *Victoria, Seychelles,* 1913, p. 17.

In connection with mosquito larvae (mostly *Stegomyia*) an experiment was made at Government House with the local small fish called Goujon (*Haplochilus playfairi*), which differs little in habits from the celebrated "Millions" fish of Barbados (*Girardinus poeciloides*). In a small basin where mosquito larvae were teeming 50 goujons were introduced one afternoon, and the next morning not a single larva was found and none has ever been found since, while the small fish, after two months, started to multiply considerably. This experiment may serve to show that there is in the Seychelles an effective enemy of mosquitos, the fish being able to live in the smallest pond.

LAWS (H. E.). **How Ticks are Killed when Cattle are Dipped.**—*Agric. Jl. of the Union of S. Africa, Pretoria,* vi, no. 1, July 1913, pp. 49-54.

In view of the importance of knowing exactly in what way ticks on cattle are killed during dipping, further experiments have been made recently. There are three theories advanced to account for the death of the tick when poisons are added to the dipping bath:—(1) that the tick absorbs the poison through its skin whilst the animal is passing through the dipping bath; (2) that the absorption of the poison through the skin of the tick takes place after dipping; and (3) that the beast absorbs the poison into its skin, the tick sucking in the poison with the juices extracted during the process of feeding. As regards the first theory, experiments were made in which ticks were weighed before and after immersion in water; the results showed that during the first hour of immersion, the tick lost in weight. As an animal only takes 10-15 seconds to swim through the dip, it is impossible that the poison is absorbed by the tick. As regards the second theory, it is thought highly improbable that the absorption of the poison takes place after dipping, as the fluid dries in less than on hour, during which period it has been proved that no absorption takes place. All evidence supports the third theory, that the tick sucks the poison from the body of the animal with the juices it extracts for food. The author says that local injections of arsenic have caused death to the ticks in that neighbourhood, and although they did not come in contact with the arsenic, arsenic was found in the body of the tick. The poison injected into the animal's skin does not enter the blood stream, but is taken up by the lymph, which is extracted by the tick. It is necessary therefore that the cattle dip should penetrate the animal's skin uniformly and thoroughly. This can only be done by using a dip containing an oil emulsion.

MARCHOUX (E.) & COUVY (L.). **Argas et Spirochetes.**—*Ann. Inst. Pasteur, Paris*, xxvii, no. 6, pp. 453-480, 25th June 1913, 15 figs, and no. 8, 25th Aug. 1913, pp. 620-643.

The authors give a summary of the relationship between the spirochete and the tick as described by Dutton and Todd, Leishman, Balfour, Fantham, Blanc and Hindle, and summarise the results of their own investigations as follows:—(1) In *Argas persicus*, granules resembling those first described by Leishman in *Ornithodorus moubata* were found; (2) these granules have no relation to the spirochete; (3) that it is impossible to introduce them under the skin of animals capable of infection without inoculating spirochetes at the same time; (4) spirochetes were found in the coelom of all the specimens of *Argas persicus* examined by the authors; (5) these spirochetes were often very delicate and were not coloured by the Giemsa stain but were brought out by gentian violet; (6) others still more delicate were found which remained almost invisible no matter what the stain employed; (7) the authors failed to clear infected specimens of *Argas* from their spirochetes; (8) a large number of spirochetes ingested by a specimen of *Argas* immediately passed through the intestinal wall and distributed themselves about the coelom; (9) those which remained in the gastric caeca degenerated in 8 to 12 days; (10) the breaking up of the chromatin in the spirochete cannot be considered as a transformation of these organisms into granules, but is rather a process of degeneration; (11) Leishman's granules differ from spirochetes in a large number of characters and re-actions; (12) they exist normally in many Acarids; (13) the authors have not observed in spirochetes living in an invertebrate host any morphological modifications which could be considered as anything else than bacteria.

In the second part of their paper the authors summarise their conclusions as follows:—(1) The injection of equal quantities of the ground pulp of *Argas* sometimes causes infection and sometimes gives immunity; (2) the infective quality depends upon the number of spirilla which the Acarids contain; (3) it is possible to measure the infective dose, the vaccination dose and the inert dose; (4) all the organs of *Argas* are invaded by the parasites; (5) the spirochetes pass from the coelom into the acini of the salivary glands and gather together in their excretory duct; (6) the secretion of the salivary glands is the vehicle of infection; (7) the spirochetes are found in a great number of the cephalic glands and can pass through the chitinous membrane of the egg; (8) a single egg of *Argas persicus* may contain more than 30 spirochetes.

Kling (C.) & Levaditi (C.). **Etudes sur la Poliomyelite Aigue Epidemique.** [Studies of Acute Epidemic Poliomyelitis.]—*Ann. Inst. Pasteur, Paris,* xxvii, no. 9, 25th Sept. 1913, pp. 718-749 (1st article).

The authors have studied the various methods by which the contagion of poliomyelitis may be carried, and devote several pages to a consideration of the possible transmission of the virus by insects. They say that the fact that epidemic poliomyelitis generally rages during summer and autumn, being usually rare in winter, at least suggests the possibility that insects may be one of the means of transmission. Flies, bugs, mosquitos and *Stomoxys calcitrans* have in their turn been accused. The authors give a summary of their own investigations in this direction as follows:—

(1) *Musca domestica.*—They are of opinion that the experiments of Flexner and Clark were too artificial to be of value (Jl. Amer. Med. Soc. 6th June 1911), and that the only deduction that could be made was, that the virus contained in the nervous system of infected monkeys was preserved for a relatively short time in the bodies of flies, and that these might possibly play a purely mechanical part in the propagation of the poison. More recent attempts of Josefson (L'Institut Med. de L'Etat, Stockholm, iii, 1912, p. 169) were carried out under more ordinary conditions and were completely negative. The authors made four experiments with house-flies, *Stomoxys* and mosquitos which had been exposed to contact with patients, in all cases the result was negative, and they are of opinion that, without denying entirely the possibility of the propagation of infantile paralysis by means of flies in a purely mechanical manner, there is no sufficient proof that this ever really occurs.

(2) *Bed-Bugs.*—The authors say that bugs may possibly spread infection among different members of the same family, but it is difficult to imagine the transport of the poison by bugs from one

house to another, especially if they are far removed from one another. The method of infection may be either by direct puncture or by scratching the skin with fingers contaminated with the blood of a crushed, virus-carrying bug. The experiments of Howard and Clark are regarded by the authors as only proving that the bugs may carry the virus for several days, but do not explain by what means the insect can propagate the disease. The authors made numerous experiments with bugs which had bitten patients suffering from the disease and report that all were negative, and they found it impossible to discover the virus of infantile paralysis in many specimens of bugs which had certainly bitten patients suffering from typical and well developed poliomyelitis. They are therefore not inclined to favour the idea that bugs do transmit the disease.

(3) *Lice and Fleas.*—Howard and Clark obtained negative results with lice, and the authors say that they themselves have been unable to experiment in this direction from want of material. They remark, as against the carriage of the poison by these parasites, that poliomyelitis may claim numerous victims in one family in spite of the total absence of lice; and as to fleas, the experiments of Howard and Clark, Kling, Petersson and Wernstedt were entirely negative.

(4) *Stomoxys calcitrans.*—A brief summary is given of the results obtained in America in the transmission of infantile paralysis by means of *Stomoxys*. The authors say that their own investigations into an epidemic of poliomyelitis at Djursö showed that *Stomoxys* was absent, and that in another place only a few of these flies were found and those in a stable at a considerable distance from the house in which the patients lived. Further, the particular flies were so feeble in consequence of the lateness of the season, that the possibility of their flight from the stable to the house was hardly credible; but in spite of this general absence of *Stomoxys* in this and other places, the disease progressed long after snow had fallen and the local conditions were utterly unfavourable not only to *Stomoxys* but to all other insects.

In spite of these general reasons for doubting the transmission of poliomyelitis by *Stomoxys*, the authors made direct experiments on a large number of living *Stomoxys* which were found in the stable above mentioned by injecting the emulsion prepared from them into the brain and peritoneal cavity of a monkey. The result was negative. They regret that, in spite of the general prevalence of the disease, they were only able to make one such experiment in consequence of the absence of the fly, and they revert to their original conclusion that the experiments of others only prove that it is possible for the virus to be preserved in the bodies of *Stomoxys calcitrans* for a relatively short time. They draw attention to the fact that although the epidemic reached its maximum during summer and autumn, it continued to rage all through the early months of winter, when biting insects are either excessively rare or entirely absent. If insect bites be the cause of the transmission of the virus it is necessary to admit the existence of an extraordinary long incubation period, whereas the American researches do not justify the extension of this period beyond 8 days. Generally, the authors are of opinion that the whole question of the transmission of poliomyelitis by insects requires much further investigation.

SELAN (U.). **Ipodermosi, Taroli o Grassine nel Bestiame.** [Hypodermosis and Warbles in cattle.]—*La Rivista di Viticoltura, Enologia ed Agraria, Conegliano,* xix, ser. 5, no. 20, 15th Oct. 1913, pp. 465-468.

The author describes in general terms the effects produced by the larvae of *Hypoderma bovis* and *H. equi* and notes the formation in France in 1910 of an association for the destruction of *Hypoderma,* quoting from a recent publication of this association a description of the affection and the best means of combating it. The measures of protection advocated are the following. Inasmuch as the insects only oviposit during flight in the hot hours of the day between July and September their reproduction can be prevented, where the system of cattle-raising permits, by keeping the animals in stalls during this part of the day. The persistent extraction of the larvae from the tumours in the skin and their destruction affords also a useful means for steadily reducing the numbers of the fly.

STOKES (T. G. N.). **Results of the Malaria Investigation in the Central Provinces.**—*Proceedings of the Third Meeting of the General Malaria Committee held at Madras, 18th-20th Nov.* 1912, *Simla,* 1913, pp. 59-60.

Endemic malaria is widely prevalent in the area investigated, particularly along the Satpura hills which run right across the province. The causes assigned are:—(1) The presence of scrub jungle, dense jungle and rank vegetation in the vicinity of villages; (2) the presence of harmful species of Anophelines, viz., *culicifacies, listoni, theobaldi* and *jeyporensis,* all of which breed in shady jungle ravines with hard stony impervious beds, which retain water to the end of the cold weather; (3) the low economic condition of the people and their poor clothing, and the abundance of mosquitos; (4) social conditions—especially the splitting up of jungle villages into groups of huts at short distances apart, which makes site clearing difficult; and finally (5) the system of watching crops round the jungle edge to frighten away pig, peafowl, etc., which exposes the villager at night to mosquito attack.

In the Vindhya range of hills in the north of the province (Saugor) although the villages greatly resemble those of the Satpuras they are not so infested with malaria. The village sites are cleared and there are few harmful Anophelines, though whether this depends upon the site clearing or upon the fact that the geology and flora of the two ranges are different has not yet been ascertained.

Hints for the Prevention of Malarial Fevers.—*Proceedings of the Third Meeting of the General Malaria Committee held at Madras,* 18*th*-20*th Nov.* 1912, *Simla,* 1913, pp. 175-176.

This leaflet, intended for general circulation, draws attention to the well-known methods of destroying mosquitos and preventing their breeding. The use of the mosquito net is inculcated, and also cleanliness, inasmuch as the cleaner the house the fewer the mosquitos. The advisability of having as few curtains and as little drapery as possible is insisted upon; and the curtains should be light in colour and of a washable material. The bare parts of the skin of children should be anointed on going to bed with eucalyptus oil, menthol or vaseline and carbolic acid, and the use of turpentine soap is advised, as such measures tend to keep off mosquitos. Other details regarding gardens and their drainage, and the prevention of pools are given, and the removal of all excessive vegetation from the neighbourhood of the house is advised, as the latter provides resting places for Anophelines during the day.

O'Gorman Lalor (N. P.). **The Aetiological Relationship of Seven-Day Fever.**—*Proceedings of the Third Meeting of the General Malaria Committee held at Madras,* 18*th*-20*th Nov.* 1912. *Simla,* 1913, pp. 207-208.

The author considers that it is possible that seven-day fever is in some way connected with the distribution of *Stegomyia fasciata* and suggests a series of experiments which he thinks might be carried out with a view to determining whether this is the case or not.

Howlett (F. M.). *Stegomyia fasciata.*—*Proceedings of the Third Meeting of the General Malaria Committee held at Madras,* 18*th*-20*th Nov.* 1912, *Simla,* 1913, pp. 205.

The author gives a general description of the genus *Stegomyia* and says that it is rarely, if ever, found away from human habitations and is known in most, if not all, of the largest towns of India. It does not as a rule breed in very dirty water and generally selects water which collects in vessels, pots, tins, etc., though occasionally it is found in the dirty water of open drains.

Operations against *Stegomyia* at Pusa have been directed towards the eradication of all natural and accidental breeding places, at the same time supplying artificial breeding places (cut joints of bamboo filled with water) which could be emptied every few days and so controlled. In captivity pairing takes place about 12 hours after emergence from the pupa and is followed by a meal of blood. About 50 eggs are laid from 2-4 days later and these begin to hatch 48 hours after oviposition, though some may not hatch until several days later. The larval period is variable and dependent on local conditions, the shortest time observed between hatching and pupation being 5 days and the longest 22 days. The author regards a week as a likely average. The pupal stage lasts 2 to 3 days. The adult rarely, if ever, bites after dark, but is particularly bold and troublesome by day. In the case of other species of *Stegomyia* which occur at Pusa (these do not include *S. fasciata*) eggs laid in the cool weather do not hatch until the following rains, lying in earth and dried mud throughout the whole of the dry season and the author thinks that in those places which have a well marked cold or dry season the same thing will probably happen in the case of *Stegomyia fasciata.*

PATTON (W. S.). **Further observations on the Development of *Herpetomonas donovani* in *Cimex rotundatus* and *Cimex lectularius*.**—*Proceedings of the Third Meeting of the General Malaria Committee held at Madras*, 18*th*-20*th Nov.* 1912, *Simla*, 1913, pp. 221-232.

The author refers to his previous work which he regards as proving that the parasite is capable of carrying its development in the bed-bug to the post-flagellate stage, provided that, during the course of this development, the insects do not take a second meal of blood. A large number of experiments were made at temperatures suitable for the development of the parasites, and the author arrives at the following conclusions:—

(1) The parasite of Indian kala-azar will flagellate in the bug at a high temperature, but instead of multiplying, it dies out and disappears in about five days after it is ingested; (2) the parasite will also flagellate in the bug at a low temperature, and though it persists in the insect for about twelve days after it is ingested, it never multiplies to any extent, but dies out; (3) the parasite flagellates and persists for a few days in bugs kept at a temperature varying from 73° F. to 80° F., but here again it never multiplies but dies out.

The temperature corresponding with that of the months of December and January in Madras appears to be the most suitable for its development in the bug; it is then able to pass on to its post-flagellate stage. It is, the author thinks, a very striking fact that the parasite of Oriental Sore in Cambay behaves in a still more peculiar way, in that it will only flagellate in the bug below a temperature of about 75° F. The parasite of kala-azar, on the other hand, will flagellate in the bug at a high temperature, but fails to multiply and soon disappears.

BEQUAERT (J.). **Muscides Hematophages et Culicides.** [Blood-sucking Muscids and Culicids.]—*Revue Zool. Africaine, Brussels*, Vol. III., Fasc. 1, 1913, pp. 12-23.

In this paper a list is given of the blood-sucking MUSCIDAE and mosquitos found during the scientific mission to Katanga, in the Belgian Congo, with a short reference to the habits of the insects. The MUSCIDAE are represented by:—*Stomoxys calcitrans* var. *korogwensis*, *S. brunnipes*, *S. taeniatus*, *S. bouvieri*, *Glossina palpalis*, *G. morsitans*, *G. pallidipes*, and *G. brevipalpis*. The CULICIDAE comprise:—*Toxorhynchites brevipalpis*, *Anopheles funestus*, *A. costalis*, *A. wellcomei*, *Mucidus mucidus*, *Stegomyia simpsoni*, *S. apicoargentea*, *Culex guiarti*, *C. duttoni*, *C. ager*, *Ochlerotatus cumminsii*, *O. minutus*, *Mansonioides uniformis*, and *Banksinella luteolateralis*. The author also obtained an undetermined species of *Culicoides* and of *Simulium*.

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The Editor will be glad to receive prompt information of the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion, the adoption of which would increase the usefulness of the Review.

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Howlett (F. M.). **The Breeding-places of** ***Phlebotomus*****.**—*Proceedings of the Third Meeting of the General Malaria Committee held at Madras, 18th-20th Nov.* 1912, *Simla*, 1913, pp. 209-210.

The author says that the study of the natural breeding places of sand-flies is difficult owing to the minute size of the larvae and the fact that their colour harmonises with that of damp earth. So far as the district around Pusa is concerned, there is no evidence that the breeding places are restricted to one particular type of locality on which it might be possible to concentrate the application of remedial measures. In Pusa the necessary conditions appear to be:—(1) a moderate degree of moisture, roughly equivalent to that of good garden mould in England; (2) protection from light; (3) the presence of nitrogenous refuse, particularly the debris of dead insects, decayed fungi and perhaps insect and other excreta; an excess of nitrogenous matter, however, appears to be distasteful and unsuitable; (4) the presence of bricks, stones, tiles or cement has been associated with all but one of the breeding places hitherto seen. This is probably due to the fact that these substances are comparatively cool and often have condensed moisture on the surface, while they also act as a protection from the light. The author points out the frequent association of sand flies with the common wall-lizards. A description of four localities from which larvae or pupae have been obtained at Pusa is given.

Townsend (C. H. T.). **Progress in the Study of Verruga Transmission by Bloodsuckers.**—*Bull. Entom. Research, London*, iv, pt. 2, Sept. 1913, pp. 125-128, 3 pls.

The experiments made during May and June, 1913, upon the means of transmission of verruga have shown that the disease is probably not transmitted by ticks or mites, and the author now points out that all the known Peruvian Acari are excluded as possible carriers, owing to the fact that in no case does the distribution of any species coïncide with that of the disease.

Evidence seems to point to the fact that the transmission may be due to biting gnats. Collections were made of all possible biting insects, which included mosquitos, species of *Ceratopogon* and other Chironomids, *Simulium*, Tabanids, fleas, bugs, *Stomoxys* and lice; but all these were excluded from the list of possible transmitters of the disease, as they also occur outside the verruga zone.

The author spent a night at San Bartolomé, a well-known centre of verruga in the Rimac valley, below Verrugas canyon. With two candles in front of the window in the railway station, he caught over a hundred small gnats between 6.30 and 9.30 p.m. These gnats, he was told, sucked blood and were called "titira" by the natives. He was informed, however, that the true "titira" had white wings and breeds in the hills. This at once suggested *Phlebotomus*. The species captured were chiefly Ceratopogoninae.

An Italian, who had been breaking rock in camp between Verrugas canyon and San Bartolomé, arrived at the station, evidently suffering from verruga, and he acknowledged that he had been much bitten by titira in the evenings while in camp. Material collected later proved to include a *Ceratopogon* and an *Orthocladius*, which both occur also at Chosica, and two specimens of a *Phlebotomus*, with mouth-parts well adapted for sucking blood.

Phlebotomus does not occur at Chosica. The natives gave information to the effect that they were more prevalent at night in the neighbourhood of Verrugas canyon than at San Bartolomé at this season.

It is well known that verruga localities are always situated near deep narrow canyons, with much vegetation, heat and little ventilation. This fits in with the habits of *Phlebotomus*, which avoids the wind, the sun and even full daylight. They come out at sunset and enter houses not too strongly lighted, and during the day lie hidden in loose earth, in caves, or within the interstices of rocks. This explains both the " excavation " and " soil " theories of infection.

That the men employed in building the Central Railway Bridge in 1909 escaped infection when they passed their nights at Chosica, is explained by the fact that the gnats do not come out until sunset and are at all times absent from Chosica.

So far it has not been possible to obtain sufficient *Phlebotomus* material to experiment with, but it is expected that when experiments are made, the work will give positive results as regards the connection between *Phlebotomus* and verruga infection.

BECKER (Th.). **Dipteren aus Marokko.** [Diptera from Morocco.] —*Ann. Mus. Zool. Acad. Imp. Sci., St. Petersburg*, xviii, pt. 1, 1913, pp. 62-85.

In this list of Diptera, 204 species in all, the following TABANIDAE are given as having been collected at Tangier:—*Tabanus pulchellus*, Lw., *T. barbarus*, L., *T. vittatus*, F., *T. tomentosus*, Macq., *T. ater*, Rossi, *T. alexandrinus*, Wied., *T. autumnalis*, L., and *T. molestans*, sp. n.

DOANE (R. W.). **An Annotated List of the Literature on Insects and Disease for the Year 1912.**—*Jl. Econ. Entom., Concord*, vi, no. 4, 1913, pp. 366-385.

The literature published in 1912 concerning all questions bearing on the transmission of disease by insects, is classified under the names of diseases, and under the names of insects or other animals which share in the transmission. In every case an account is given in a few words of the scope of the papers mentioned. The list is confined to English and American journals.

RANSOM (B. H.). **The Life-History of *Habronema muscae* (Carter), a Parasite of the Horse transmitted by the House-Fly.**—*U.S. Dept. Agric. Bureau of Animal Industry, Washington, Bull.* 163, 1913, 36 pp., 11 figs.

This is an account of the life history of a Nematode worm which infests horses. The embryos of the worms are thrown out with the alimentary dejecta, and enter the bodies of fly larvae which have hatched from eggs laid on the dejecta by house-flies (*Musca domestica*). The young worms grow in the fly larvae and reach their final stage at about the time the flies emerge in the winged state. In the flies the parasites are commonly found in the head, and frequently in the proboscis, but they also occur in the alimentary canal, and in the thorax.

KNAB (F.). **Changes in the Mosquito Fauna of Panama.**—*Proc. Entom. Soc., Wash., Washington*, xv, no. 1, 1913, pp. 40-43.

The changes in the physical features of the region of the Panama Canal will, as has often been pointed out, bring about changes in the fauna of that zone. There are even now data to show that such changes have already occurred. In working over the mosquito material from the Canal Zone collected in 1907, the absence of the species *Mansonia titillans* was very marked, as it is elsewhere very plentiful. It would seem that the creation of Gatun Lake has since been a cause of its introduction into that neighbourhood. The same is the case with *Aëdomyia squamipennis*. Both these insects, which are now plentiful in the Canal Zone, are associated with the aquatic plant *Pistia*, in their larval stages. This plant grows in shallow water with its leaves floating on the surface, and the *Mansonia* larvae are attached to its roots; but how the *Aëdomyia* is attached is not known.

In discussing this paper Mr. Busck said that many mosquitos and other insects have been eradicated from the Canal Zone owing to the improvements in sanitation, etc. That the opposite should have occurred in the case of the above-mentioned species is attributed to the introduction and increase of the plant *Pistia*, and in combating them it will probably be necessary to destroy the floating islands of this plant.

TRÄGARDH (I.). **On the Chemotropism of Insects and its Significance for Economic Entomology.**—*Bull. Entom. Research, London*, iv, pt. 2, Sept. 1913, pp. 113-117.

By 'chemotropism' is meant a guiding force perceived by an animal through its olfactory sense. It is an important factor in the life of insects, and is especially so in the three following circumstances: (1) In the search of the sexes for each other; (2) in the search for food; and (3) in ovipositing. It is a matter of common knowledge that the males in certain species of moths seek out the females from a great distance. In 1910 Verschaffelt published the results of his investigations upon the choice of food exerted by insects. He found that all the plants (various Cruciferae and mignonette) which are fed upon by the larvae of *Pieris brassicae* and *P. rapae* contain a particular glucoside, one of the mustard oils. He then smeared a dough of *Bunias orientalis,* which contains this substance, upon the leaves of a plant that the caterpillars had refused to eat; when thus treated the leaves were eaten. Similar results were obtained in experiments with the larvae of a herbivorous Hymenopteron, *Priophorus padi,* which is attracted to members of the order Rosaceae, by the glucoside amygdaline, that the plants contain. As regards the existence of a chemotropic influence guiding the female where to lay her eggs, in order that the young may hatch out upon suitable food material, Howlett published some confirmatory results last year. He succeeded in causing *Sarcophaga* to lay eggs in a bottle containing skatol—a product of the decomposition of albuminous material; and further, he caused *Stomoxys calcitrans* to oviposit upon a cotton rag moistened with valerianic acid—a substance resulting from the decomposition of vegetable matter. Dr. Trägårdh draws the conclusion that "the ovipositing of the females is guided, even in those cases where the larva has a diet different from that of the adult, by chemotropism." If this be generally the case, a knowledge of chemotropism in insects should afford an excellent means of controlling pests; if the female could be attracted to lay eggs elsewhere than on the plant which it naturally attacks, a complete prevention of the pest would be brought about. As yet very little work has been done upon these lines, but it seems probable that the work of Verschaffelt, Dewitz, and Howlett will prove to be of inestimable value to economic entomologists.

Coventry (B.). **Report of the Director.**—*Report Agric. Research Inst. & Coll., Pusa,* 1911-1912, *Calcutta,* 1913, pp. 10-11.

Reporting upon the work of the section of Pathological Entomology, the Director says that special attention has been paid to the genus *Stegomyia,* and allied forms of mosquitos, owing to the possibility of yellow fever being imported into India from Panama. Other subjects receiving attention are the breeding places and habits of *Phlebotomus,* the life-history of the Crab-louse (*Phthirius pubis*), the parasites of *Tabanus albimedius, Monophlebus stebbingi,* and the life-history of Celyphidae. The East Indian Railway school at Jharipani was successfully rid of a plague of bugs by the application of hydrocyanic acid.

Aphis-infested Rape and its Effect on Sheep.—*Agric. Gaz., N.S.W., Sydney,* xxiv, no. 9, Sept. 1913, p. 758.

During the present year sheep were fed on aphis-infested rape, to see if there was any truth in the supposition that the death of certain sheep in 1911 was correlated with the infestation by aphids of rape that they had eaten. The results of the experiments were in the negative; after eating aphis-infested rape for 6 days, the sheep showed no signs of illness.

MAJOR (H. S.). **The Maggot Fly Pest in Sheep.**—*Agric. Gaz., N.S.W., Sydney*, xxiv, no. 8, Aug. 1913, pp. 645-652.

The Maggot Fly is responsible for the loss of millions of sheep annually throughout Australia; its increase during the past ten years is attributed largely to certain years of drought. There are four species of blow-fly on sheep—*Calliphora villosa*, *C. ocenia*, *C. rufifacies* and *Lucilia sericata*. Sheep with wool containing the greatest amount of grease (suint) are the most liable to attack. Dips have been used without much success, as the maggots are extremely resistant and can withstand tar, kerosene, etc. Any dip must be such that it will destroy the maggot without interfering with the wool or harming the skin of the animal; it should not be poisonous as the sheep might poison itself by biting its own wool and skin; and it must be cheap and easy to apply. No such specific is at present known, although many are being tried on different farms. Crutching is recommended, and it should be done about 6 months after shearing. From experiments conducted by the Clarence Board of Agriculture in Tasmania in 1909 as to the effects of arsenical dips on ticks, it was shown that a proper immersion would kill the ticks and nymphs; but the treatment of the maggot is more difficult. The adoption on all stations of a rigid system of properly burning all dead sheep and other stock must have a good effect in checking the rapid increase of the flies. If burning is impracticable on account of a lack of wood, burying may be substituted.

SWINGLE (L. D.). **The Life History of the Sheep Tick** (*Melophagus ovinus*). — *Univ. Wyoming Agric. Expt. Stn., Laramie*, Bull. 99, July 1913, pp. 1-24, 3 figs.

In the present paper the life-history of this parasitic fly alone is discussed, the consideration of its eradication being left for a later bulletin. The whole life of the fly is spent on the sheep and therefore its life-history is less complex than that of the true tick. As is well known, the egg hatches and the larva develops through all its stages within the body of the female, being extruded as a mature larva, which changes into a pupa about 12 hours later. (For convenience, the term pupa is used to designate the offspring from the time of extrusion until emergence.) The pupal stage lasts during the summer from 19-23 days; in the winter from 19-36 days, when the sheep are kept in a barn, and probably longer if they are kept outside. The time from emergence to deposition of the first pupa varies from 14-30 days, and pairing takes place within 3 to 4 days after hatching. The ticks do not live more than a few days off their host. Females were kept under observation for 5½ months.

There is a great mortality among the young before they take their first meal. A female that lives 4 months would deposit from 10 to 12 pupae; for one living 6 months the number would be 15 or more. A sheep free from ticks may be kept for months beside a heavily infested one, with a partition only three feet high between them, without becoming infested. Sheep ticks have very little instinct for migration, this being especially true of the females.

Buttrick (P. L.). **The Effect of Tides and Rainfall on the Breeding of Salt Marsh Mosquitos.**—*Journ. Econ. Entom., Concord,* vi, no. 4, Aug. 1913, pp. 352-359.

The author was placed in charge of a campaign against mosquitos in New Haven, Connecticut. The chief species to be controlled was the banded salt-marsh mosquito, *Culex sollicitans,* Walk. The eggs are laid on the salt marsh mud and lie dormant until covered by water, either tide or rain. They then hatch in a few hours, and in 6-15 days the adults emerge. The marshes where the mosquitos breed are usually flooded at certain periods when the tides rise above the general level. Shortly after this happens, a brood of mosquitos is liable to emerge. In an oiling campaign, a knowledge of the time of the unusually high (or perigee) tides is of the greatest importance, as it gives an opportunity for making preparations for controlling the brood following upon it. The paper deals largely with the methods, meteorological and otherwise, used in making a forecast as to when these tides will occur. The height of the maximum high tide at a given station for each day of the mosquito season is plotted as a curve. The next point is to determine at what height of tide a given marsh is flooded. This may be done (1) by setting a tide gauge at some convenient point on a stream or in the marsh; (2) by ascertaining the general level of the marsh with reference to mean low water; and (3) by visiting the marsh at high tide on different days, and determining by observation at what height of tide they are flooded. By drawing a line across the high tide curve, at a height corresponding with the height of the flood line, it can be seen at a glance at what time flooding will take place. The following shows how the method works in practice. On Saturday, 10th August 1913, the maximum high tide was predicted from the curve as 6·8 feet. This is sufficient to flood the West River Marshes. Development in ordinary August weather generally takes about one week; hence oiling, to be successful, had to be done before the following Saturday night, 17th August.

Although rainfall is a factor in the abundance of mosquitos, it does not necessarily follow that the more rain the more mosquitos. So far as salt-marshes are concerned the time and amount of the precipitation are of great importance. A rain-storm occurring when the tides almost reach the flood line may be sufficient to raise the water-level so that a brood is produced: while at another period, when the tide is low, the same amount of rain may be carried off without its first covering the marsh. Rain may at times actually prevent breeding by giving enough moisture to cause the eggs to hatch, but insufficient water for the needs of the larvae. Investigations of the relations of the tides and rainfall to the breeding of salt-marsh mosquitos are far from complete.

Winslow (C. E. A.). **Museum Co-operation in the Teaching of School Hygiene and Sanitation.**—*American Mus. Jl., New York*, xiii, no. 7, Nov. 1913, p. 317, 3 figs.

In this address, delivered before the fourth International Congress of School Hygiene at Buffalo, it is urged that the teaching of hygiene in schools in New York should be accompanied by demonstrations of the exhibits in the New York Museum, many of which are arranged specially from a hygienic point of view. The relation of insects to disease affords a particularly fruitful field for museum work; the museum contains enlarged models of mosquitos, and of the house-fly. A wide series of facts bearing on the life-history of the fly are illustrated, as well as the relation of the fly to disease, the practical methods for its control, and the results achieved thereby. A similar model of the flea which carries plague, is under preparation. It is hoped to develop this plan in connection with the mosquitos of malaria and yellow fever and other insect disease-carriers, in a few years.

Fiske (W. F.). **The Bionomics of Glossina; a Review with Hypothetical Conclusions.**—*Bull. Entom. Research, London*, iv, pt. 2, Sept. 1913, pp. 95-111.

In this paper the author offers an explanation to account for the local disparity between the sexes, and the apparently arbitrary distribution of the fly, observed in the case of various species of *Glossina*. He believes that a connexion exists between the observed phenomena of sex disparity and specialised migratory movements.

The results of many experiments lead to the following conclusions:—(1) that local sex disparity is characteristic of *G. palpalis*—for example, Kinghorn and Montgomery made catches on the island of Matondwi, near the southern shore of Tanganyika, in which 91 per cent. to 98·8 per cent. were males; (2) that such a disparity is independent of the season; (3) that it is not due to the production of the sexes in unequal numbers—Carpenter bred 1,400 flies from pupae collected upon the island of Damba (where males largely predominate), and obtained the sexes in approximately equal numbers; (4) that in some manner it is associated with the conditions of the shores of lakes and large rivers. The results depend on the assumption that the proportion of the sexes in a lot of flies caught, is indicative of the proportions of the sexes prevailing in that locality; from experiments made with marked flies which were set free and re-caught, it is concluded that the assumption is correct.

To account for sex disparity the writer says that there are two alternatives; either (1) some agency exists which causes a greater rate of mortality of males in one locality, and which is complemented by some other agency similarly prejudicial to the opposite sex in another locality; or (2) the males migrate to, or the females from, localities where males predominate, and *vice versa*. The first alternative is upheld by Kleine, who suggests that a diet of crocodile's blood reacts more disadvantageously on females than on males. This leads to the inference that islands, where males predominate, are unfavourable places for the fly on account of bad food; but since the race remains abundant, it follows that conditions are actually highly favourable, for the fewer the females the higher must be the rate of reproduction in order to maintain these numbers. Other observed facts cast doubt, according to the author, on Kleine's conclusions. The author considers that the second alternative is the most simple and most logical way of explaining the facts, viz.: that one sex migrates from localities where the other is predominant; he is satisfied moreover, that it is the females which migrate, and supports this view by arguments from analogy with other orders of insects, by considerations of the physiological condition of the female in early life, and by the fact that islands are on the whole favourable breeding places (pupae are most easily collected on them), and it would seem more likely that females would migrate from the islands to the mainland, than that males would migrate to the islands.

Considering the meaning of such migrations, the author looks upon it as a factor of natural control; as no specialised parasites or natural enemies of *G. palpalis* have been found, some other factor must operate to keep down the number of individuals to the most favourable level. Migration of females would act in this way, and would also serve as a means of dispersal of the species.

When localities actually favourable to increase of the species are compared with localities actually unfavourable, it is not improbable, according to the author, that points of difference will be discerned, which may be of value for economic application. The extent to which these conclusions regarding the bionomics of *G. palpalis* in a certain geographical region will apply to the same species in other regions, or to other species, is considered to be as yet wholly problematical.

HIRST (S.). **On Three New Species of Gamasid Mites found on Rats.** —*Bull. Entom. Research, London*, iv, pt. 2, Sept. 1913, pp. 119-124, 4 figs.

Although a great majority of the GAMASIDAE are not parasitic in habit, a number of true parasites belonging to this family are known to occur on vertebrates (birds, small mammals, especially bats and rodents) and on arthropods. Gamasid mites belonging to different genera are known to infest rats which frequent human dwellings, and it is possible that these mites are responsible for the conveyance of plague and leprosy to human beings; the following is a list of these genera :—*Myonyssus*, *Leiognathus* (= *Liponyssus*), *Dermanyssus* (= *Liponyssoides*), *Laelaps*, and *Haemogamasus*. *Dermanyssus avium* has been known to attack human beings, and species of *Laelaps* and *Leiognathus* have been found on man; Neumann records a case in which a house was infested by *Laelaps stabularis*, Koch, which seriously affected the health of one of the inmates.

Three new species of Gamasid mites are described, viz., *Dermanyssus muris*, taken from rats (*Mus rattus*) in the cities of Madras and Colombo; *D. aegyptius*, taken from *Acomys cahirinus*, *Arvicanthis* sp., and *Mus rattus* in Egypt; and *Leiognathus bacoti*, taken from *Mus norvegicus* in Egypt. *Laelaps echidninus*, Berlese, is recorded from *Mus norvegicus* in London and the United States, and from *Mus rattus* in Colombo.

STANTON (A. T.). **The Anopheles of Malaya. Part I.** — *Bull. Entom. Research, London*, iv, pt. 2, Sept. 1913, pp. 129-133, 4 figs.

This is the first of a series of papers in which it is proposed to give the results of a detailed study of the individual species of the *Anopheles* mosquitos of the Federated Malay States. In the present paper the egg, the newly-hatched larva, the mature larva and the pupa of *Anopheles tessellatus*, Theo., are described.

STRICKLAND (C.). **The *Myzorhynchus* Group of Anopheline Mosquitos in Malaya.**—*Bull. Entom. Research, London*, iv, pt. 2, Sept. 1913, pp. 135-142.

A systematic revision, which has already been anticipated by the work of Stanton and Alcock [see this *Review*, Ser. B, pp. 5 and 131]. The author regards *Lophoscelomyia* and *Patagiamyia* as synonymous with *Myzorhynchus*, in which he recognises five Malayan species :—*sinensis*, *barbirostris*, *umbrosus*, *albotaeniatus* and *asiaticus*. Revised descriptions are given of these species.

CRAGG (F. W.). **Studies on the Mouth Parts and Sucking Apparatus of the Blood-sucking Diptera.**—*Scientific Mem. by Officers of the Medical & Sanitary Depts. of the Government of India, Calcutta*, no. 60, 1913, pp. 1-56, 5 pls.

The present memoir deals entirely with the comparative anatomy of the proboscis in the blood-sucking MUSCIDAE, particularly *Musca nebulo*, *Philaematomyia gurnei*, *P. lineata*, *P. insignis*, *Haematobia irritans*, *Stomoxys calcitrans*, *Lyperosia minuta*, and *Glossina submorsitans*. Conclusions are drawn as to the evolution and relationships of the MUSCIDAE. They are probably all derived from a *Musca*-like ancestor; the first steps in the evolution of the blood-sucking habit can be seen at the present day in those flies which are blood-suckers but have no biting mouth-parts. These depend on true biting flies for the making of the wound. In the genus *Philaematomyia* there are three species which show separate steps in the modification of the *Musca*-like proboscis to a biting apparatus. The changes all depend on the increase in size and functional importance of the prestomial teeth. Between the genus *Philaematomyia* and the STOMOXYDINAE there is a wide gap, the proboscis in the latter being a piercing one in the true sense of the word. In the flies, in the order given above, there is an increase in the relative length of the haustellum, and a diminution in that of the rostrum, together with some diminution in the amount of movement between the latter and the head capsule. *Glossina* represents an extreme case; the alterations in the structure and the diminution in the amount of movement are the same in kind as in *Stomoxys*, but greater in degree.

LUTZ (A.). **The Insect Host of Forest Malaria;**

KNAB (F.). **Contentions regarding Forest Malaria.**—*Proc. Entom. Soc., Washington*, xv, no. 3, Sept. 1913, pp. 108-118.

In a paper read before the Washington Entomological Society, Dr. Lutz upholds his theory that outbreaks of malaria amongst men working in uninhabited forests in Brazil, far from towns or dwellings, are caused by the bites of *Anopheles lutzii* (= *A. boliviensis*). In the present paper he does not state from what source the mosquito itself becomes infected, but he points out that it would be likely that mosquitos which usually feed upon wild animals would take to biting human beings where those animals were rare. He further points out that such malaria outbreaks were common in damp marshy situations, but not where it was dry; or in other words, in regions favourable to the breeding of mosquitos, but not in regions unfavourable.

Dr. Knab replies to these arguments in a second paper. He points out that it is unlikely that a typically forest-breeding form such as *A. lutzii* should be capable of transmitting malaria, since it is generally held on physiological grounds that the transmission of malaria is confined to very definite species, all of which frequent towns and dwellings, which *A. lutzii* does not. He suggests that in many cases malaria has been contracted by the men in towns, and has only developed after their return to the forest.

Dr. Dyar puts forward three alternatives to account for the outbreak of malaria under the conditions described:—(1) that the true insect carrier was overlooked; (2) that the disease was spread by *A. lutzii* from a latent case among the men; and (3) that there exists a form of malaria among wild animals in the forest, conveyed by *A. lutzii*, and that man is subject to this disease when exposed to the bites of mosquitos already infected from wild animals.

Dr. Dyar himself holds that either the true insect host has been overlooked, or that the men have contracted the disease on visits to towns. He regards the chance as remote that a non-domestic species of *Anopheles*, never before having carried human malaria, should be in a condition to do so when malaria cases were presented. The third alternative he regards as no more than a possibility, since no malarial organisms are at present known to inhabit wild animals and to be transferable to man. If such a condition exist, it is in need of proof.

Continuing the discussion, Dr. Jennings describes other cases of malaria breaking out in uninhabited regions. In searching for mosquitos in connection with such outbreaks he failed to find any which are associated with malaria in towns. He refers to Dr. Lutz's statement that malaria was common in damp regions but not in dry ones, and suggests that most of the workmen probably had latent malaria in their systems, which the damp conditions would bring out, whereas in dry situations the disease will remain latent.

The Yellow Fever Danger for Asia and Australia, especially after the Opening of the Panama Canal.—*Jl. Trop. Med. & Hyg., London*, xvi, no. 18, 15th Sept. 1913, pp. 292-293.

The present account deals with the distribution and biology of *Stegomyia fasciata* (*Aëdes calopus*) in Asia and Australia, with reference to the possible spread of yellow fever to those continents, following upon the opening of the Panama Canal. *S. fasciata* can remain infective very long after having bitten a yellow fever patient. In tropical seas this insect not only remains alive but can also breed on board-ship, so that the disease may be carried by ship over considerable distances. On account of this it seems certain that so long as yellow fever occurs in America, the possibility of infected *Stegomyia* being transported to Asia and Australia remains. As to whether the conditions in the latter continents would favour the establishment of the disease, it is thought that, if one may judge from temperature conditions, yellow fever, once transported, will be able to hold its own and be propagated further; and it is known that *S. fasciata* is already widely distributed in Asia and Australia.

Regarding measures to be taken in those areas against yellow fever, it is advised that every ship arriving in the *Stegomyia* zone be made to remain at a sufficient distance from the coast, and there be examined for mosquitos, larvae, and yellow fever patients. If mosquitos and larvae are found, they should be killed, and patients should be carried from the ship in mosquito nets and nursed in a mosquito-proof hospital. As a further precaution the whole ship should be fumigated. It has been pointed out that yellow fever is endemic not only on the Atlantic, but also on the Pacific side of America, in countries where the execution of hygienic measures is irregular, and it has been suggested that in consequence of this, all ships sailing from a yellow fever port to an Asiatic one, should be obliged to touch first at the fumigating station at Panama.

CHALMERS (A. J.) & KING (H. H.). **The Distribution of *Glossina longipennis* (Corti, 1895).**—*Jl. Trop. Med. & Hyg., London,* xvi, no. 20, 15th Oct. 1913, pp. 320-322, 1 map.

To-day all species of *Glossina* must be regarded with suspicion, as the number associated with the spread of sleeping sickness in man appears to be slowly increasing. It is therefore valuable to know the distribution of the various species as accurately as possible. The known area of distribution of *G. longipennis* extends from about 6° N. Lat. to about 4° S. Lat. and from about 33° to about 47° E. Long. This area includes the following political divisions:—British East Africa, the south and west of Italian Somaliland, the southern part of Abyssinia, and the south-eastern portion of the Anglo-Egyptian Sudan. The localities where the fly is found are either desert or semi-desert. When seen in elevated regions it occurs between rivers, not on their banks. The fact that it is usually a night-feeder may explain why it is seldom reported by travellers, and perhaps why males have been more commonly met with than females.

STANLEY (A.). **Shanghai Municipal Council Health Department Annual Report, 1912.** (Abstract.)—*Jl. Trop. Med. & Hyg., London,* xvi, no. 22, 15th Nov. 1913, pp. 353-360.

Periodic examination has been made of mosquitos collected from each of the sanitary districts into which the Settlement is divided, and the following have been found:—*Myzorhynchus sinensis* (malaria-bearing), *Stegomyia scutellaris* (yellow fever bearing), *Culex fatigans* (the host of filaria) and *Armigeres ventralis.* The prophylaxis of malaria resolves itself into, (1) suppression of mosquitos; (2) prevention of infection of man by mosquitos; (3) prevention of infection of mosquitos by man.

HENRY (M.). **The Tick Problem in New South Wales.**—*Agric. Gaz., N.S.W., Sydney,* xxiv, pt. 10, Oct. 1913, pp. 829-837.

The object of the work against the cattle tick is to eradicate it from New South Wales, or, failing that, to confine it to its present areas, and to prevent the introduction of tick fever into the State. The tick concerned is *Boophilus (Margaropus) australis.* Its natural hosts are cattle, on which it thrives best, but it also attaches itself to horses, sheep and other animals. The life-history of the tick is given in a pamphlet published by the

Chief Inspector of Stock. The eggs are extremely resistant to cold; they are laid on the ground in summer or winter. The larval ticks attach themselves to blades of grass and lie in wait for passing cattle. Having gained its host, in a week the larva casts its skin and emerges as an eight-legged nymph; a week later it moults again and emerges as a sexually mature adult.

The result of tick-bites upon the animal is what is known as tick worry, which must be distinguished from tick fever, the former being due to the mechanical irritation caused by the ticks and to loss of blood. Tick fever is caused by minute parasites, *Piroplasma bigeminum*, which destroy the red blood corpuscles. They are taken up by the tick when it sucks blood, and when the egg laid by such a tick hatches out, the tick arising from it is capable of transmitting the parasite to any cattle to which it may fix itself.

The methods which have been used to combat the tick consist of dipping and spraying with arsenical dips. Regarding the risk of dipping cattle in such poisonous dips, it is stated that fatalities amongst stock dipped in properly prepared solutions, under good management, seldom exceed 1 in 1,000. Cattle may be safely dipped in or sprayed with an arsenical dip containing an equivalent of 0·24 per cent. arsenic trioxide or less; this is according to experiments made in America. Inoculation against tick fever is not at present practised in New South Wales, as the disease is unknown there.

Figures are given to show the cost of combating the tick in New South Wales. It is stated that £20,000 is spent annually on the erection of dips, establishment of salting stations, appointment of inspectors, maintaining dips, etc.

Hodge (C. F.). **The Distance House-Flies, Blue-Bottles and Stable-Flies may travel over Water.**—*Science, New York*, xxxviii, 10th Oct. 1913, pp. 512-513.

Plagues of flies were reported from the cribs of the water-works, situated 1¼, 5 and 6 miles respectively out in Lake Erie, and investigations were made to find the cause. As all waste matter, or anything that could serve as food for the flies, is put into the lake or burned at once, it does not appear that the flies are attracted by the hope of getting food. Also it is known from experiment and observation that flies do not as a rule travel more than 500 yards from their breeding places, though they have been known to fly for a mile and a quarter. The flies found at the three cribs were house-flies (*Musca*), stable-flies (*Stomoxys*) and blue-bottles (*Calliphora*). The explanation seems to be that they are blown by the wind for at least six miles and that they gather on the cribs as temporary resting places. All the flies in the crib appeared to be very hungry, and it should therefore not be difficult to trap the house-flies and blue-bottles as fast as they come. They could probably be killed most easily with 2·5 per cent. formalin in milk, beer, or sugar and vinegar mixture.

Knab (F.). **A New American** *Phlebotomus.*—*Insecutor Inscitiae Menstruus, Washington*, i, no. 11, Nov. 1913, pp. 135-137, 1 fig.

A new species of *Phlebotomus*, which occurs in association with man, is described, viz. *P. atroclaratus.* It was taken on Gasparee Island, Trinidad, in August 1913, by Mr. F. W. Urich.

Massonnat (E.) & Vinet (C.). **Ethologie et pupation chez les Diptères pupipares et les Oestrides.** [Ethology and pupation in pupiparous Diptera and in Oestrids.]—*C.R. Hebdom. Soc. de Biol., Paris*, lxxv, no. 26, 18th July 1913, pp. 49-51.

The authors say that in the course of their studies of pupiparous Diptera and of Oestrids they have endeavoured to breed the insects from larvae. Their attempts were not always successful and sometimes were attended with great difficulty. The larvae of *Melophagus ovinus*, L., and *Hippobosca equina*, L., extruded before maturity remained white and never produced adults. This premature birth of an immature larva may be provoked artificially by slightly pressing the abdomen of the female when gestation is well advanced. Properly developed larvae turn brown in two or three hours. Similar observations were made on *Hypoderma bovis*, de Geer, and the authors' observations lead them to the conclusion that in order that the larva of *Hypoderma* may develop, it must remain in its host until the moment before pupation. This is not the case with the larvae of two other Oestrids, *Gastrophilus equi*, F., and *Oestrus ovis*, L. In June and July a large number of larvae detached either from the stomach of a horse or the nasal fossae of a sheep may remain from one to three days on non-nutritive media and still mature properly. The authors say that this capacity for maturation away from the host results from the fact that the parasitism of these insects is not so accentuated as that of *Hypoderma bovis.* In the last larval stage of *Hypoderma* the movements are extremely restricted. On arriving at maturity the larva enlarges the opening in the skin and falls to the ground; it turns black almost immediately, and about 2 hours afterwards is transformed into a rigid pupa.

The larva of *G. equi*, if placed upon friable soil, partly buries itself. It is more mobile than the larva of *Hypoderma*, but much less active than that of *Oestrus ovis*, which is quite capable of escaping from a glass vessel.

The duration of pupation is determined by the temperature. In *H. equina* it varies from 28 to 35 days at a temperature of 20° to 21° C. (68°-9° F.); but if kept at 35° C. (95° F.) the period was only 25 days, whilst a pupa, in August, on Mount Pilatus at 700 metres above sea-level, required 50 days for the emergence of the insect. *Oestrus ovis* required 27 to 29 days at a constant temperature of 35° C. (95° F.).

Hypoderma bovis during the whole of its larval period is exposed to exceedingly constant conditions of temperature and abundant nutrition, yet shows very great individual variations. Pupae from the same host placed in identical conditions showed a difference of 6 days in the time required for development.

Sergent (Edm.). **Infection de Fièvre Récurrente par les Muqueuses chez l'Homme.** [Infection with Recurrent Fever through the mucous membranes in a man.]—*C.R. Hebdom. Soc. de Biol., Paris*, lxxv, no. 28, 1st August 1913, p. 185.

The author refers to the recent investigations of Nicolle, Blaizot and Conseil [see this *Review*, Ser. B. pp. 70-72] that the infection of intermittent fever is carried to man through abrasions of the skin caused by scratching and crushing infected lice upon it or by rubbing the eyes with the contaminated nail. In further proof that infection by this means is quite possible, he records the case of three persons who were engaged in inoculating a monkey with blood containing spirilla, during which, by a sudden movement of the animal, the syringe was detached from the needle and all three received a sprinkling of blood on the forehead and in the eyes. One wore spectacles and escaped infection, the other two developed the symptoms of recurrent fever in a grave form 8 days afterwards.

The Public Health and Buildings Ordinance (No. 1 of 1903), as amended up to 31st December 1912.—*Hongkong*, 1913, 167 pp.

The following is an epitome of the provisions relating to the spread of plague and other diseases.

The Sanitary Board has powers to pass bye-laws with regard to rats, and the means and precautions to be taken on shore or on board vessels in the waters of the Colony for minimising their numbers and destroying them, and for preventing them from passing from vessels to the shore or *vice versâ*. Any building containing rat-holes or similar places, or with ventilating openings unprovided with gratings shall be deemed a "nuisance." Lath and plaster walls are prohibited. Impermeable floors are required. Ventilation under boarded floors in the lowest storey is necessary, and any openings for this purpose must be protected. Ceilings are prohibited outside the European reserve, except with the permission of the Building Authority. All mooring cables, hawsers, and ropes must pass through a metal tube about 2 feet in length with a trumpet-like flange at either end in order to prevent the rats from passing either way along the cable. The flange must extend at least 8 inches clear of the rope or cable. Strong substantial movable dust-bins of impervious materials and with a closely fitting cover are required, as this not only prevents the breeding of flies, but deprives rats of a food supply. Every inlet to a drain or sewer must be provided with a trap of approved pattern. Every opening giving access to a drainage trap must be entirely protected by a fixed grating.

This ordinance also contains a provision for the prevention of the dissemination of disease by mosquitos. When larvae of of mosquitos are found on any premises the owner or occupier must remove all accumulations of water or take steps to prevent the recurrence of the breeding of mosquitos.

Report on special Investigations carried out in the Bacteriological Institute and in the Public Mortuary, Victoria, during the six months, January 1st to June 30th, 1913.—*Hong Kong*, 4 pp. Received by the Colonial Office 29th Sept. 1913.

An investigation of the mosquitos of Hong Kong was commenced in July 1912 with the view (1) to search for the presence or absence of *Stegomyia fasciata*; (2) to collect Anopheline mosquitos, with special reference to their exact distribution in the Colony, and in order to discover which of the species are malaria-carriers; and (3) to obtain a general collection of Culicines.

The *Stegomyia* survey of the city of Victoria covered a period from 1st July 1912 to 30th June 1913 and 17,361 house-visits were made, that is to say about 2 per house. The percentage of houses in which larvae were found varied markedly with the season of the year and the positive results obtained by Inspector Watson were found to be considerably higher than those recorded by the ordinary Sanitary Staff. The Inspector found larvae in from 80 per cent. of the houses visited downwards to almost nil in cold weather in February. On the other hand the Sanitary Staff figure was never more than 10 per cent. The writer of the Report does not consider the Inspector's figures as an over-estimate, and says that, on the contrary, his results would have been considerably higher but for the fact that he became so well known to the Chinese that his appearance in the street was a signal for a general emptying of pots, water-barrels, etc. Some 1,238 samples of larvae were obtained from more than as many houses and 6,511 mosquitos were bred out and pinned. A larger number were examined and as they were all of the same species were not preserved. The examination is not yet completed, but with one exception, no *Stegomyia fasciata* were found. The predominating mosquito is *Stegomyia scutellaris*, which can be found almost everywhere. *Culex fatigans* and other Culicines form a small percentage. The area in which the single specimen of *S. fasciata* was found was repeatedly searched, but no further specimens had been obtained to date. If further experience confirms the result of the work already done, a very curious position will be displayed. *Stegomyia fasciata* is recorded by Theobald as common in Japan, the Philippines and Singapore. From all these places ships are constantly coming to Hong Kong, and as *S. fasciata* is said to be a good traveller on ships, it would appear that it must frequently have been brought to the town. Dr. Werkman, of Leyden, who has been working on mosquitos at the Institute, had no difficulty in collecting and bringing back specimens of *S. fasciata* from the ports of Tandjoing Priok, Semarang and Soerabaya in Java, during a trip on the Dutch steamship line which is constantly running between Hong Kong and Java. There is no doubt that many ships have entered the port of Hong Kong for many years past from ports infested with *S. fasciata*, so that there has been ample opportunity for the importation of the insect. Similarly Dr. Chan Tsun Kun, the Government Bacteriologist at Canton, has informed the writer of the Report that in spite of diligent search no S. *fasciata* have been found in Canton.

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The Review of Applied Entomology is intended to contain, month by month, abstracts of the latest information published concerning insects injurious to man or animals, as the carriers of disease; and to forests, fruit trees, crops or stored merchandise.

The Editor will be glad to receive prompt information of the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion, the adoption of which would increase the usefulness of the Review.

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* Erroneously recorded in the text as a *Culex*.

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NOTICES.

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

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